CONSTRUCTION TRENDS

Notes on significant movements in the construction industry

Far West Construction Sets Record

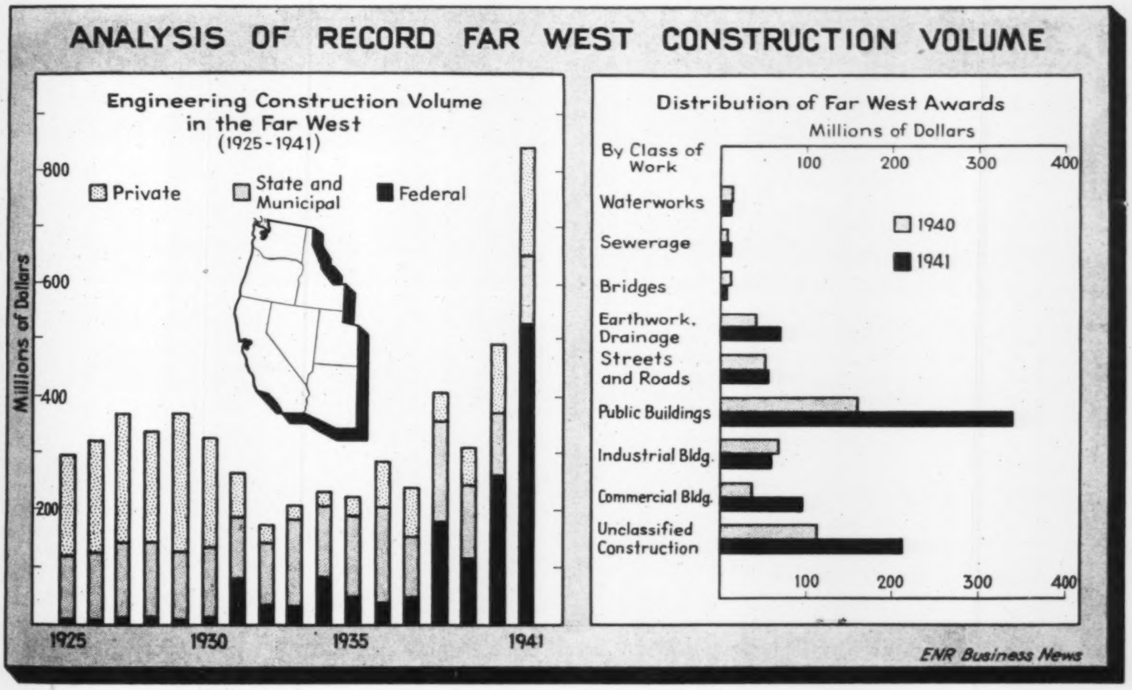
ENGINEERING CONSTRUCTION in the seven Far Western states, $846,547,000, established a new high in 1941, exceeding the previous peak of 1940 by 72 percent. Awards for 1941 in these states totaled 14 percent of the United States engineering construction volume, the highest share reported for this region since 1934.

Better than a quarter of the earthwork, irrigation and drainage facilities awarded in the nation during the past year were in the Far West; 21 percent of the unclassified construction volume came from these seven states; 19 percent of the commercial building and large-scale private housing; 14 percent of the waterworks awards; 12 percent of the public building total; 12 percent of the industrial building volume; 11 percent of the sewerage facilities; 9 percent of the highway lettings; and 6 percent of the United States bridge construction total.

Public construction rose to $650,428,000, a new high, 74 percent above a year ago. Over four-fifths of this volume, $528,322,000, was for federal work, more than double the high of 1940.

Private construction climbed to $196,119,000 in the past year, aided primarily by the increased volume of privately-financed mass housing near defense plants and military areas. The private total was the top figure reported since 1929, and 63 percent higher than in 1940.

War plants, military and civilian defense housing, camps, barracks, etc., which combine to make up the public building classification, were 39.7 percent of the 1941 Far West volume. Unclassified construction, which includes airports, airbases, transmission and communication lines, shipyards and shipways, etc., made up 24.8 percent; commercial building and large-scale private housing, 11.1 percent; earthwork and drainage, 8.1 percent; industrial buildings, 6.9 percent; highways, 6.2 percent; waterworks, 1.3 percent; sewerage, 1.1 percent; and bridges, 0.8 percent.



ANALYSIS OF RECORD FAR WEST CONSTRUCTION VOLUME

ENR Business News

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Birthplace of Battleships Guns and Tanks

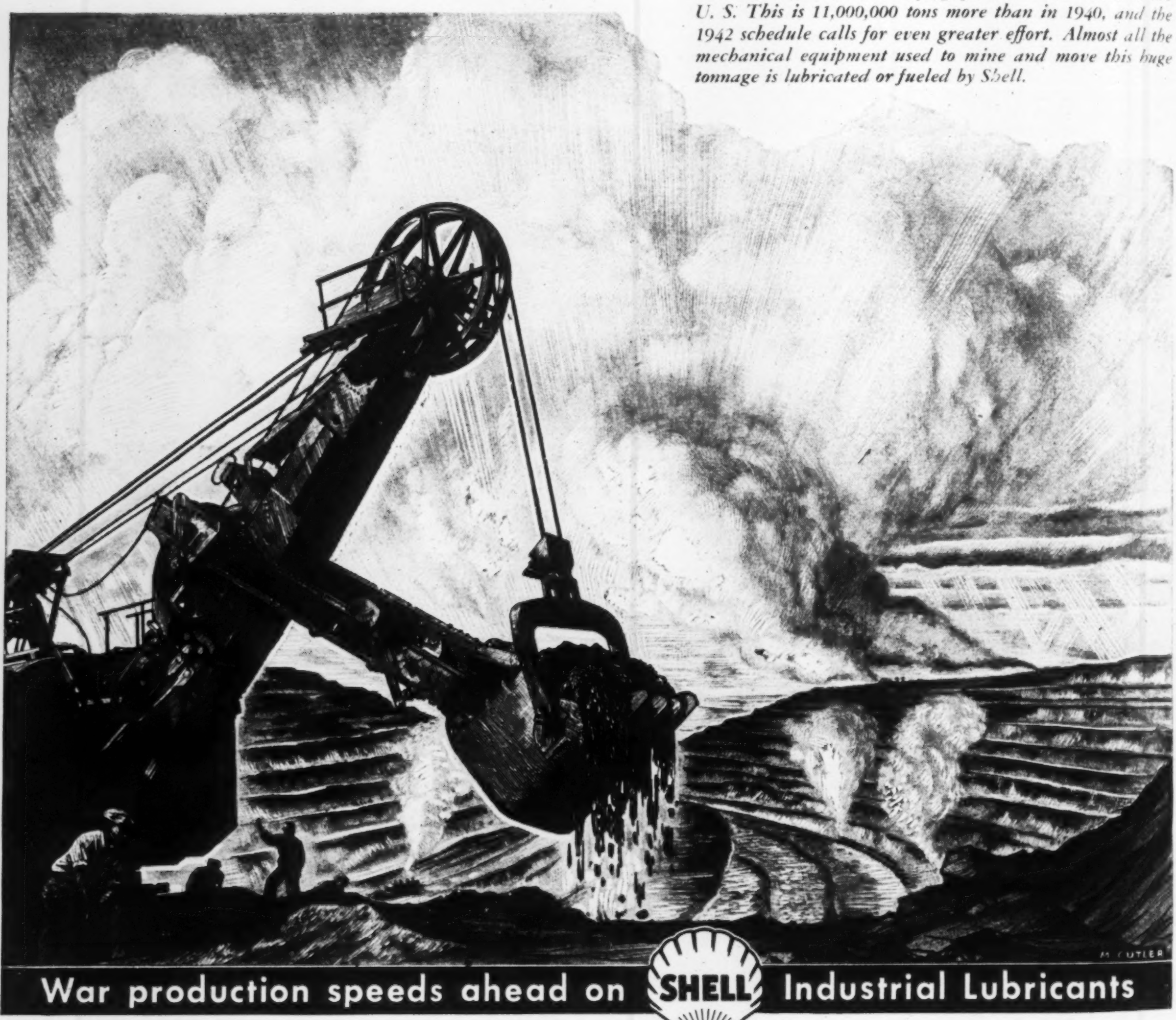
World's largest iron mine operated by Shell-Lubricated equipment

GREATEST SINGLE SOURCE of raw material for war production is the huge deposit of iron ore at Minnesota's Mesabi Range. More than 60,000,000 tons of ore were taken from this mammoth range in 1941, and this year's production will be even larger.

The fact that almost every shovel, tractor, truck and train on the Mesabi Range is lubricated or fueled by Shell offers unusual proof of Shell's ability to handle the toughest lubrication problems. Nevertheless, Shell oils and greases are constantly being improved to meet the ever more exacting demands of full-time production schedules. The Shell lubricants in use today are the result of constantly advancing technical research and development . . . are giving dependable service under conditions only a year ago considered impossible to solve.

Is your equipment getting this kind of up-to-the-minute lubrication? Call Shell and be sure. No matter what your lubrication problems may be, you will find Shell can be very definitely helpful in increasing the speed and quality of your production.

1941 output of iron ore at Mesabi Range *totalled more than 60,000,000 tons, nearly ⅔ of all iron ore mined in the U. S. This is 11,000,000 tons more than in 1940, and the 1942 schedule calls for even greater effort. Almost all the mechanical equipment used to mine and move this huge tonnage is lubricated or fueled by Shell.*



War production speeds ahead on SHELL Industrial Lubricants

ENGINEERING NEWS-RECORD

Devoted to Buildings, Sewers, Waterworks, Bridges, Highways, Streets, Dams, Foundations, Earthwork, Flood Control, Public Works, Irrigation, Canals, Railroads

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Vol. 128 JANUARY 29, 1942 No. 5

THIS WEEK

• Two articles of unusual and timely interest appearing in this issue are: "Bomb Tests of Materials and Structures", and "Water Supply in Air Raids". The former deals with tests conducted by the War Department at the Aberdeen (Md.) Proving Ground on various types of structures to determine their resistance under actual bombing. The latter article covers experiences in England, and offers specific information of vital importance in handling the water supply problem during and after air raids.

• Following up an article on the design of the cofferdam at TVA's Kentucky Dam, which appeared in *ENR*—Jan. 1, we review in this issue construction procedure on the job, which involved the driving of 19,500 tons of steel sheetpiling, 80 x 100 ft. long, for the first stages of the work.

• California stands in the forefront of the states building divided highways. For that reason an article on practices in that state is published in this issue as a forerunner of an article summarizing current practices in divided highway design to be included in the forthcoming Feb. 12, issue.

ANNUAL HIGHWAY NUMBER

• Current trends in highway design and construction will be the subject of the Annual Highway Number, to be published Feb. 12. Developments covered include concrete and bituminous highways, soil stabilization as applied to embankment construction and road surfacing, divided highway design and timber bridges for highway work. Also included will be reports from the individual states on their highway work for 1941 and their plans for 1942.

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★ ★

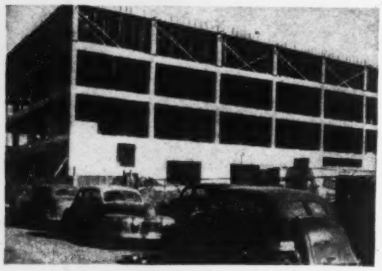
SPEED UP DEFENSE CONSTRUCTION WITH ATLAS HIGH-EARLY CEMENT!

When time must be saved on any construction project, specify Atlas High-Early cement. It's made to order for speeding up construction in winter or summer . . .

★ ★ ★

SPEED in building cantonments, defense housing, naval bases, roads, runways. Speed in building, converting and repairing defense factories. That's today's "must." And SPEED's the reason builders are specifying Atlas High-Early cement.

Specify it for any type of new concreting work, for conversion of existing plants, or for quick, lasting repairs. In actual application Atlas High-Early cement is similar to normal portland cement . . . easy to work with, requires no special equipment.



● Atlas High-Early cement saved three to four weeks' time in construction of this Appleton Electric Company building in Chicago. *Architect:* Robert C. Ostergren; *Engineers:* Smith & Brown; *Contractor:* Carl E. Erickson Co.

SAVES TIME: *Look what Atlas High-Early cement has done on these typical jobs:*

- **Saved 72 days on new factory.**
- **Saved 13 days on machine tool plant addition.**
- **Saved 12 days on foundations.**
- **Saved 24 days in winter construction.**
- **Saved 25 days concreting at freezing temperature.**
- **Saved one week in finishing factory floor.**
- **Cut one month off three-month building schedule.**
- **After 70 hours made concrete strong enough to hold 560 tons of steel.**

SAVES MONEY: *On many jobs Atlas High-Early saves money, too. For example:*

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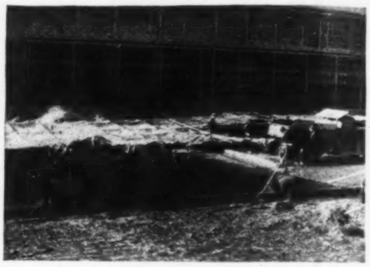
- **Saved $288 in fuel costs.**
- **Saved two sets of forms.**
- **Saved 20,000 ft. of lumber and 20,000 ft. of plywood.**

Specify Atlas High-Early cement to speed up defense housing; to speed up new cantonments; to speed up defense industry construction; to speed up construction of administrative buildings, hospitals, warehouses, roads, runways . . . any kind of concrete work.



● Defense expansion was pushed ahead 13 days with Atlas High-Early cement at the Monarch Machine Tool Company, Sidney, Ohio. *Architect:* Schenk & Williams; *Contractor:* M. C. Ferguson.

NOW IS THE TIME to speed up rush jobs with Atlas High-Early cement. Specify it for your next job. Universal Atlas Cement Company (United States Steel Corporation Subsidiary), Chrysler Building, New York City.

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ENR-H-42

ATLAS HIGH-EARLY CEMENT

A UNIVERSAL ATLAS PRODUCT

The Week **In Engineering and Construction**

ENGINEERING NEWS-RECORD • JANUARY 29, 1942 • VOLUME 128 • NUMBER 5

Negotiated fee contracts are attacked and praised

Vinson and Truman committees of Congress reach opposite conclusions on contracting procedure. Low profits found on construction work performed for the Navy.

Diametrically opposed conclusions on the justification for use of negotiated rather than competitive lump-sum contracts were reached in reports submitted this month by Congressional committees investigating the war program. The House naval affairs committee, reporting on its investigation of profits by Navy contractors, concluded that the government has obtained more favorable prices on negotiated than on competitive contracts.

On the other hand, Senator Truman's committee investigating the defense program concluded from its studies of Army cantonment and ordnance plant construction and the defense housing program that negotiated fee contracts have been responsible for excessive costs and should be avoided.

The naval affairs committee, under chairman Carl Vinson, reported that profits on competitive bid contracts awarded by the Bureau of Yards and Docks in recent years averaged 7.09 percent. Meanwhile, profits on negotiated contracts averaged 4.38 percent. Profits on all construction work investigated (representing about half the Navy construction contracts) averaged 4.43 percent.

This low profit figure for construction contracts compares with an average profit of 7.99 percent on all naval contracts. Construction is one of the lowest of all categories, contrasting with about 13 percent on ship repair, 6 percent on ships, 4.75 percent on aircraft.

Even as regards individual contracts, which in most other categories occasionally ran pretty high, the committee found only two sizable contracts in the last three years on which profits were large—a $2.172.000 contract of the Pacific Bridge Co., 12.5 percent; and a $1,016.000 contract of Robert E. McKee, Texas, 16.4 percent.

The Vinson committee complimented the Bureau of Yards and Docks on this evidence of close dealing with its contractors. The Truman committee, investigating Army and Federal Works Agency construction, found much to criticize in the negotiated contract.

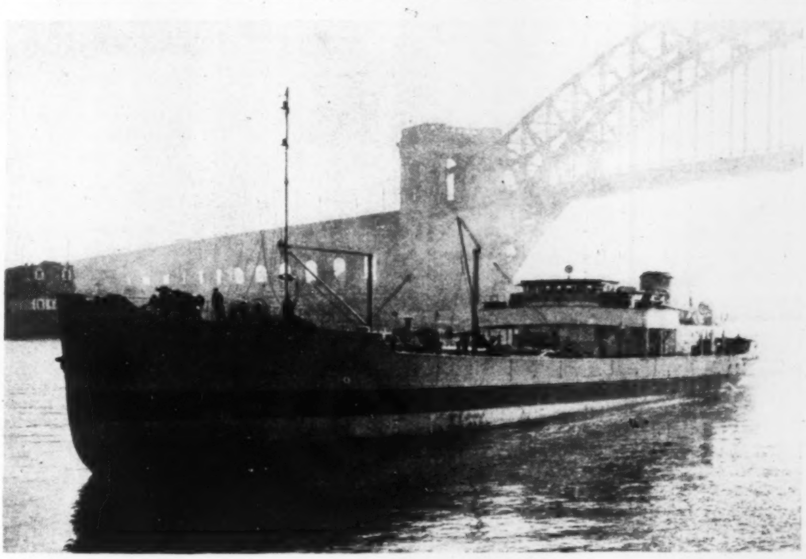
Discussing the housing program, the Truman committee reported that the competitive lump sum contracts awarded by the USHA have generally resulted in greater speed and efficiency than have the negotiated fee contracts largely used by the Public Buildings Administration. The committee recommended that the Lanham Act be amended to require competitive bidding. Congress did not accept this recommendation, and current intention at FWA is to rely heavily on negotiated lump-sum contracts.

Reviewing its studies of the Army cantonment program, the committee laid much of the blame for high costs on the fee contract. It points out that cost per man of building cantonments on a lump-sum basis was $380, while on fee jobs the cost ran to $684.

• • •

Pollock protests listing by Congress committee

That the George Pollock Co., well known contractors of Sacramento, Calif., should be listed as among those getting "excessive and unconscionable" profits from Navy defense contracts was protested last week by George G. Pollock in a letter to the House naval affairs investi-



Sludge boat "navy" defies submarine menace

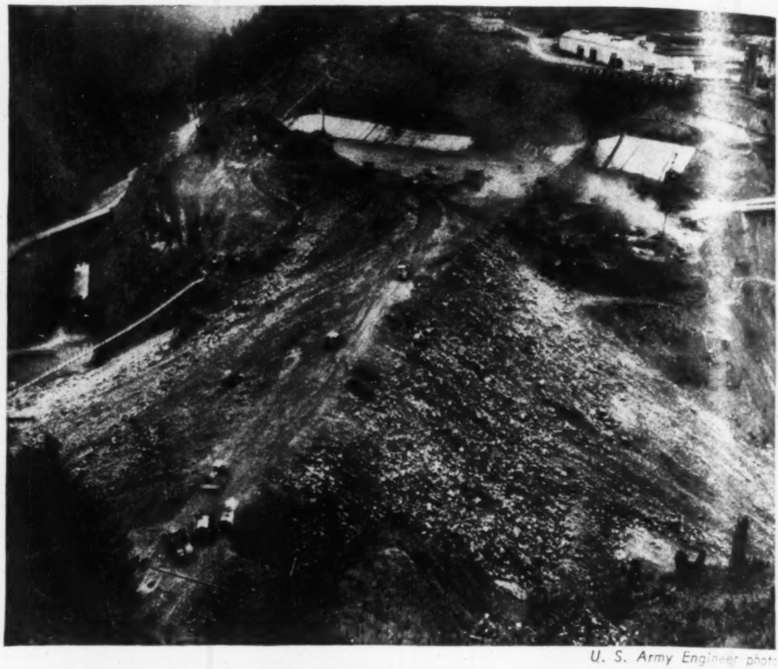
After being held in port for ten days while submarines roamed the Atlantic coast, the New York City fleet of three seagoing sludge boats resumed operations on Jan. 27. The boats carry liquid sludge from the city's sewage treatment plants for disposal some twelve miles offshore.

Of the same design as the one shown above, the boats are sturdy steel vessels, Diesel-propelled. They have a length of 257 ft. and a beam of 43.5 ft. The sludge carrying capacity is about 1,600 tons, divided among six compartments located amidships.

During the period when the boats were not permitted to leave the harbor, they discharged sludge in the waters of Long Island Sound. Daily sludge accumulations from the three New York City treatment plants served by these boats amount to some 4,000 tons, according to Richard H. Gould, acting deputy commissioner, Department of Public Works.

gating committee, which made the charges. The specific item listed was a $2,556,590 contract for a graving dock (which the committee called a breakwater) on which a $780,122 profit was realized. Mr. Pollock points out that not only was the contract secured in August, 1937, and therefore can hardly be classed as a defense contract, but that it was secured by competitive bidding against six other contractors at a price $1,605,393 less than the average bid.

The committee's conclusion that profits on all defense contracts should be limited to 7 per cent is challenged by Mr. Pollack, in so far as firm-price contracts that carry a high risk are concerned. "The previous dock built adjacent to the one in question required 5 years to build and bankrupted two contractors," says Mr. Pollock, in emphasizing that the profit on his contract "was only commensurable with the hazards involved and was the result of skillful and well planned operations." In contrast to firm price contracts Mr. Pollock suggests to the committee that on cost-plus or negotiated fixed-fee contracts 7 percent profit is more than ample.



U. S. Army Engineer photo

Earth-and-rock-fill dam reaches record height

Mud Mountain Dam, the earth-and-rock-fill structure on the White River 47 mi. southeast of Seattle, Wash., which has the record height of 425 ft., is here shown as it appeared when the crest was brought up to final grade in December 1941. The view looks downstream and shows bulldozers working the downstream slope. Below the dam is the bridge and roadway across the canyon over which much of the rock was hauled in from the quarry. The total yardage in the structure is 2,230,000 cu.yd. of which 412,000 cu.yd. is rolled earth core much of which was put through the drying plant seen here in process of being dismantled on the abutment at the far end of the dam. Note the concrete-lined spillway. In the background are temporary buildings of the Guy F. Atkinson Co., contractors for the U.S. Engineers.

• • •

Navy seeking men for construction regiment

The Navy is seeking to enlist men with construction experience to form construction regiments for service at shore establishments outside the continental United States. Clerks, draftsmen, mechanics, etc., are wanted. Ratings to be filled range from ordinary seaman to chief petty officer, depending on age and experience. Enlistment is for the duration, pay is $36-99 a month, depending on rank, with clothing, shelter, medical expenses and the like provided. An additional $34.50 a month is paid to men with dependents.

Men wishing to enlist should apply to their local recruiting station for a medical examination. If they are found eligible, they should then write to Commander E. J. Spaulding, U. S. N. R., Rm. 3442 Navy Building, Washington, for an enlistment application form.

• • •

First mass contract let for prefabricated houses

With $153,000,000 to spend on 42,000 prefabricated defense houses, Assistant Federal Works Administrator Baird Snyder started the program off last week with an initial letting of a mass contract for 2,000 homes to Plywood Structures, of Los Angeles, Calif.

Although the project site has not been selected, the houses will be erected in the California area to accommodate families of workers in the congested defense-production area. The contracting firm has been allowed 120 calendar days to complete delivery.

Of the 2,000 houses to be erected, 300 will contain one bedroom, 1,200 two bedrooms, and 500 three bedrooms.

The 42,000 prefabricated houses to be erected under the $153,000,000 appropriation passed by Congress (*ENR*, Jan. 15, p. 73 and Jan. 22, p. 145) will be in addition to more than 70,000 defense homes of permanent construction to be built by FWA under the new Lanham Act Amendment.

The prefabricated housing will be carried out under the direction of Rufe B. Newman, Jr., special FWA assistant in charge of construction.

• • •

Col. Hugh Casey promoted for gallantry in action

Col. Hugh J. Casey, Corps of Engineers, U. S. Army, is one of the five officers nominated for promotion to the temporary rank of brigadier general for distinguished leadership and gallantry in the defense of Bataan Peninsula in the Philippines. The President has recommended the promotion to Congress on the recommendation of General Douglas MacArthur. In 1937, Col. Casey, then a captain, was sent to the Philippines to be technical adviser to the Philippine government on engineering projects, a position which he held until his return to this country in 1940 to become chief of the design and engineering section of the construction division of the Quartermaster Corps. Last summer, at the request of General MacArthur, he was sent back to the Philippines.

• • •

Navy takes over fleet of Merritt-Chapman & Scott

The Navy has negotiated a contract with the Merritt-Chapman & Scott Corp. of New York City, whereby it acquires the entire salvage fleet of the company.

The contract provides that the corporation will continue to operate its vessels and stations under the direction of the Chief of the Bureau of Ships, U. S. Navy, together with such additional facilities as made be provided by the Navy. The fleet will be used for the salvaging of all vessels, public or private, needing such assistance on either coast of the United States or in Alaskan or Caribbean waters.

TVA and highway funds reduced from last year

Appropriations for the TVA and for federal aid highways for fiscal year 1943 are substantially less than in the current fiscal year as included in the Independent Offices Appropriation reported out of committee last week. To carry on the projects of the Tennessee Valley Authority, $136,100,000 is appropriated, about $30,000,000 less than for fiscal 1942. This, however, is supplemented by $30,000,000 for Douglas Dam included in a war appropriation.

Highway appropriations ordinarily mean little, are automatically adjusted to cover the obligations created by the highway authorization bills. However, provision for fiscal 1943 of amounts well below authorized obligations presumably indicates belief that material shortages will prevent the states from carrying out the full authorized programs. For primary federal aid roads, the bill provides $20,000,000 to meet 1942 obligations and $40,000,000 for obligations accruing during fiscal 1943. For secondary roads, $6,000,000 is provided against 1942 authorizations, nothing against 1943. Against 1941 authorizations $22,000,000 is provided for grade crossing elimination, and $500,000 is appropriated against 1943 authorizations for public land roads.

No money is appropriated for new construction of public buildings.

The National Advisory Committee for Aeronautics gets $6,000,000 to continue construction of its Moffett Field and Cleveland laboratories.

• • •

Sale of water bonds saves Birmingham $1,400,000

The city commission of Birmingham, Ala., has sold $4,250,000 of water supply refunding bonds to bear 2.7 percent interest, which saves the city about $1,400,000. A pumping station to increase the water supply from 30 gpd. to 55 gpd. will be built at a cost of $30,000.

• • •

Minnesota starts post-war construction fund

Through an executive order, Governor Harold E. Stassen, of Minnesota, has directed the state highway department to set aside $3,000,000 to June 30, 1942; the money to be used in a post-war highway program to cushion unemployment. Approximately $1,000,000 for new buildings will also be reserved for later developments. It is hoped that a $15,000,000 cash fund can be accumulated by July 1, 1943.

The plan is to add to the reserve fund during the war period, and at the end of hostilities to have a substantial cash cushion ready to put to work with a carefully planned program of improvements.

During the emergency all non-essential highway work and public buildings will be eliminated. The money which normally would be spent on such projects will go into the reserve fund. It is Governor Stassen's will that legislative appropriations be made from current taxes to build up the reserve, and such a bill will be recommended to the legislature.

Governor Stassen is putting into effect the general wartime fiscal policies recently recommended for all 48 states by a special committee of the Council of State Governments. He is president of the Council and was among the leading advocates of a savings policy plan by state governments.

• • •

Mexico plans record construction in 1942

That engineering construction works of various kinds, principally roads and irrigation projects, will be pushed by the Mexican government this year, is indicated by the 1942 federal budget allotment of $12,300,000 to the Ministry of Communications and Public Works. This assignment to the Ministry is the largest in the history of the Mexican government.

Pirnie made president of consulting engineers

Malcolm Pirnie, consulting engineer, New York, was elected president of the American Institute of Consulting Engineers at a meeting of the council of the institute held on Jan. 20. Rear Admiral R. E. Bakenhus (retired) was elected vice president, James Forgie was re-elected treasurer and Philip W. Henry, secretary. New members of the council are: O. H. Ammann, New York; A. J. Hammond, Chicago, and Harold E. Wessman, New York. Announcement of the election of these new members of the council was made at the annual dinner of the institute held in New York on January 19.

WASHINGTON HIGHLIGHTS

Centralized Purchasing of equipment for war houses—stoves, plumbing and perhaps electrical fixtures, cabinets, etc.—is to be used to much greater extent than in the past for houses built under the new appropriations. Whereas the Procurement Division of the Treasury bought equipment for less than a fourth of the houses so far built, it will be used to equip about 85 percent of the houses in the new program, will spend about $57,000,000.

Purchases will be pooled rather than earmarked for specific projects. As soon as Federal Works Agency notifies Procurement of the number of houses to be equipped, it will invite informal price quotations, f.o.b. factory, will then negotiate contracts for definite quantities. Amounts bought from a single supplier will be held down with the objective of spreading the work and particularly of placing contracts in areas suffering from shutdown of civil industry. As the goods are manufactured they will be warehoused, at the plant or elsewhere, and requisitioned out as needed for specific projects.

To Minimize Construction of buildings for new arms factories, an Industrial Building Utilization Section has been set up in WPB's Division of Purchases. Function of this unit will be to survey available vacant industrial buildings and arrange for their use.

Construction of Air Raid shelters will get no priority assistance, WPB announces. To build even the most economically-designed shelters in number sufficient to house any substantial portion of the seaboard population would require "fabulous" amounts of steel, it is pointed out—steel which might better go into armament to keep the enemy away from these shores.

Reorganization of the construction units in the War Production Board is pending as we go to press. At present most construction matters, particularly civilian construction, center in an industry branch headed by John Haynes; this branch also deals with the problems of construction material producers. Problems of military construction are dealt with by another unit under W. V. Kahler. And a lot of other groups in WPB touch on construction in one way or another. Expectation now is that all these various activities will be centered within a few days in one branch heading up, like other industry branches, under WPB's Division of Industry Operations.

Am. Soc. C. E. annual convention covers broad field of interest

All technical divisions represented on New York program with symposiums on bomb protection, post-war planning and sludge handling as highlights.

Preoccupation of many members of the American Society of Civil Engineers with defense work made a cut of about 20 percent in the registration at the annual meeting held in New York, Jan. 21-23, as compared with the previous year, but the falling off in attendance had no evident effect on interest shown in the technical division meetings.

Conferring of the honorary memberships, award of the society medals and prizes, and the report of the board of direction took place at the opening session. Honorary membership was conferred on Ralph Budd, president, Chicago, Burlington and Quincy R. R.; William Keliy, president, Buffalo, Niagara & Eastern Power Corp.; Henry E. Riggs, honorary professor of civil engineering, University of Michigan; John L. Savage, chief designing engineer, U. S. Bureau of Reclamation; and Henry M. Waite, consultant to the Director of the Budget, U. S. Government. All were present except Mr. Savage, who is abroad on special war work.

Medals and prizes

The Norman Medal was awarded to John A. Van den Broek, professor of engineering mechanics of the University of Michigan; the J. James R. Croes Medal to Col. Earl I. Brown, Wilmington, N. C.; the Thomas Fitch Rowland Prize to Oliver J. Todd, Albuquerque, New Mexico, and Sigurd Eliassen, Oslo, Norway; the James Laurie Prize to Samuel A. Greeley, Chicago; the Arthur M. Wellington Prize to Fred Lavis, New York; the Collingwood Prize for Juniors to Elmer Rock, Richmond, Va.; the Rudolph Hering Medal to Thomas H. Wiggin, New York; the Construction Engineering Prize to E. Leland Durkee, Bethlehem, Pa.; the Daniel W. Mead Prize to Don P. Reynolds, Toledo, Ohio, and to Edward Wesp, Jr., Mount Vernon, N. Y., and the Karl Emil Hilgard Hydraulic Prize, a new award, to Thomas R. Camp, Cambridge, Mass.

Defense activities

The extent to which the society has found it necessary to give attention to defense matters was evident in the report of the board of direction, presented by Geo. T. Seabury, secretary. President Frederick H. Fowler, soon after his election to office, was appointed chief of the civil engineering unit of the Construction Division of the Quartermaster Corps and served continuously in that capacity during the year. In May, Assistant Secretary C. E. Beam was called into active service in the Navy, and in September Assistant Secretary Allen P. Richmond, Jr., was called into service in the Army.

Walter Jessup, field secretary, was brought into society headquarters to replace Mr. Beam, and James E. Jagger was engaged as field secretary. In November the society opened an office in Washington with Hal H. Hale in charge.

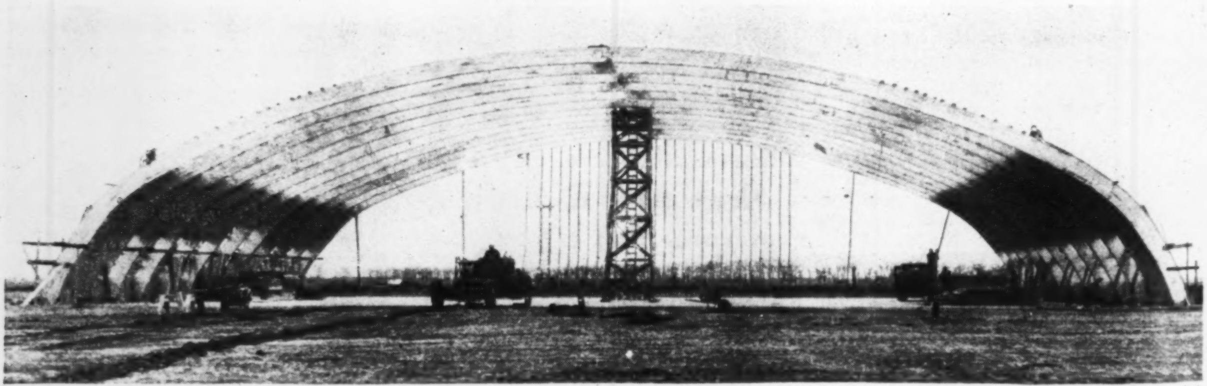
In April, Donald P. Barnes, editor of *Civil Engineering*, was called into active service, and Howard F. Peckworth succeeded him.

The board of direction voted to remit dues of all men in the military service below the rank of captain in the Army, and the corresponding grade in the Navy, upon request. Changes in the character of society meetings, due to war conditions, also was authorized by the board. Spring and fall meetings, scheduled to be held in New Orleans and Atlanta, were cancelled, but in order to permit active consideration of matters related to the war effort, informal spring and fall meetings are to be held at points to be selected by the executive committee. The annual convention, scheduled to be held in Tacoma, in July, is to be held in some more centrally located city. It also is to be an informal meeting devoted largely to matters connected with the war effort.

The board voted to expand the society's activities in matters affecting employment conditions, especially in respect to the pay and working conditions of engineers and engineering employees in war industries and war construction operations.

Waterways and coast lines

Two subjects were presented to the Waterways Division for its consideration—model studies in connection with proposed improvements in the East River Channel at Hell Gate, and planning for shore protection work in the post-war period. Col. L. S. Dillon, district engineer at New York, told how model studies at the Vicksburg laboratory had demonstrated that large savings could be made by radical changes in a plan for straightening and deepening the East River channels at Hell Gate to permit their use by large war vessels. The original plan, made without aid of models, called for cutting away the major part of Hallets' Point

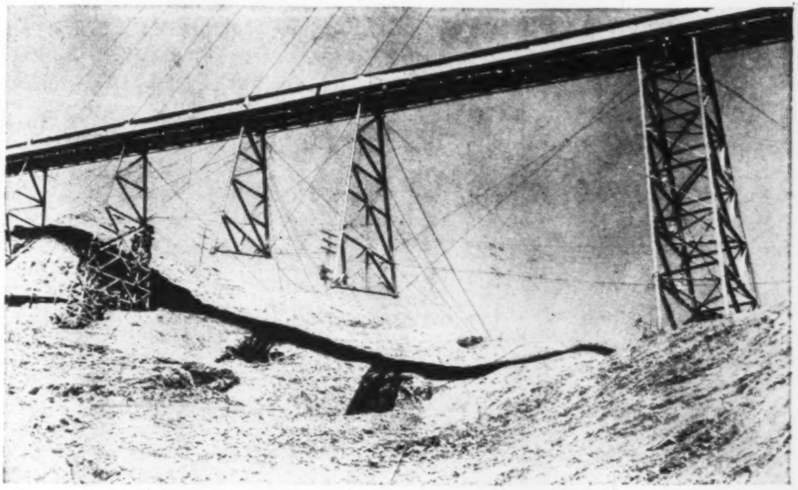


Unit Structures, Inc. photo

America's longest laminated timber arches for Northwest Airlines hangar

What is believed to be the longest glued laminated wood arches in this country are those used for the Northwest Airlines hangar now under construction at Fargo, N. D. The span is 152 ft. and the rise 35 ft. Shape of the arch was determined by the requirement that there be a 20 ft. clear height for 60 ft. each side of the center.

A 10-ft. spacing between spans avoids the need for intermediate joists, as the 2x6-in. matched roof sheathing is to be nailed directly to the arches. The arches were manufactured by Unit Structures, Inc., Peshtigo, Wis., and shipped in sections by railroad with an "idler" car at each end of the loaded car.



Shasta Dam belt conveyor hangs on "skyhooks"

Excavation for the right abutment of Shasta Dam went far into the steep slope on which are supported the last few bents of the trestle that carries the belt conveyor delivering aggregate to the concrete mixing plant under the cableway head tower. When this excavation and the attendant slipping of material began to undermine some of the bents it was not convenient to restore the footings and wire ropes were attached high up on the head tower with their lower ends carrying the belt conveyor load as shown in the picture. While so supported, the bents were guyed to prevent them from swinging in the wind and thus minimized the possible danger of having these bents break away.

on the Long Island side. The model study showed that better hydraulic conditions would be created by less straightening in the channel, which made necessary removal of only about half the point.

In discussion, Rear Admiral R. E. Bakenhus (retired) raised question as to whether it ever would be possible by model studies to determine the effect upon ships and barges of eddies and currents in altered channels. One of the major problems at Hell Gate is handling tows of barges.

Thorndike Saville, dean of the college of engineering, New York University, made a plea for greater authority for the Beach Erosion Board so that the board, on its own initiative, can undertake surveys and the preparation of plans for shore protection work that might be undertaken in the post-war period. He noted that while Congress has passed legislation recognizing federal interest in the protection of local communities against floods, it has never taken similar action with respect to the protection of shore communities from storm damage. Adoption of a national policy would permit the Beach Erosion Board to carry forward coordinated studies similar to those conducted by the Corps of Engineers with respect to flood control.

Arthur S. Tuttle, consulting engineer, New York, supported the views expressed by Professor Saville and outlined the national policy approved by the American Shore & Beach Preservation Association last May for presentation to Congress. Brig.-Gen. John J. Kingman, senior member of the Beach Erosion Board, however, disagreed with respect to federal interest in shore protection. He stated that when a bill establishing a policy as outlined by Professor Saville was placed before Congress in 1934, the Secretary of War reported to Congress that he could find no justification for any considerable amount of federal participation in shore protection because most of the properties to be protected were privately owned. Similar views were expressed to the meeting by Col. Earl I. Brown.

Another phase of water control, namely cost allocations, was covered by the Engineering Economics Division. C. I. Grimm, senior engineer, U.S.E.D., Portland, Ore., emphasized the unique character of the Willamette Valley project, in which allocations of cost to flood control, irrigation, navigation, power and stream pollution, closely approximated actual benefits.

Today and tomorrow

Two symposium sessions arranged by special committees of the society were directed toward preparedness, in one instance for bombing protection, in the other for post-war conditions, i.e., preparedness both for today and tomorrow. Enoch R. Needles, New York, is chairman of the Committee on Preparedness for Post War Conditions and Walter D. Binger, is chairman of the Committee for Civilian Protection in War Time.

From the discussions, principally of Professor Harold E. Wessman (New York University) and John I. Parcel, consulting engineer of St. Louis, it is evident that data for use in bomb-resistant designing is being rapidly accumulated, but that practices must be on an empirical basis for a long time to come. Two significant findings from the Army Engineers' Edgewood Arsenal tests are that bomb shock completely destroys the bond of reinforcing in concrete structures and that burster slabs placed above underground shelters are worse than useless if they permit a bomb to pass through them before it explodes, inasmuch as the resulting earth shock is tremendously destructive. In order that additional information of this order of importance may be accumulated, Mr. Binger urged that research and tests be expanded in every way possible, and that ingenuity in devising protective designs be encouraged. As an example of the latter, he mentioned a blast wall he had seen in England consisting of bare reinforcing bars projecting vertically from a concrete footing; under blast pressure, the bars would bend, but there would be no fragmentation such as would result if the wall were made of masonry.

The post-war symposium covered public works planning by Frank W. Herring, assistant director, National Resources Planning Board (see article by Mr. Hering in *ENR*, Jan. 15, 1942, p. 115); the Public Work Reserve, by A. D. Morrell, national director of the *PWR*; highways by G. Donald Kennedy, Michigan state highway commissioner; and municipal public works by Arthur C. Everham, director of public works, Kansas City, Mo. Taken as a group the papers give a clear expression of a determination on the part of engineers to avoid in the post-war period, the emergency type of public works programs that characterized the recent depression era.

In contrast to post-war planning the City Planning Division's program was devoted to present-day planning of cities to accommodate new defense plants. John Nolen, Jr., spoke on Washington, D. C.; Carl Berg on Louisville, Ky., and P. L. Brockway on Wichita, Kan.

Structural design

Although not billed as such, a paper on comparative tests of riveted and pin-connected joints of steel and aluminum alloys, by Leon S. Moisseiff, consulting engineer, New York, might well be characterized as post-war planning in view of the fact that structural aluminum is certain to be a prominent post-war material. The tests, which were made at the Aluminum Company's new Kensington laboratories, gave results for all types of joints that were in full agreement with design assumptions and calculations conventionally used. The aluminum alloys tested were those known as 17 ST, 27 ST, and 53 ST.

Many significant and thought-provoking statements on structural design were made by Prof. Wilbur M. Wilson, University of Illinois, in a paper that related the physical properties of carbon and low alloy steels to the behavior of such materials when used in structural members. Ductility combined with a well defined yield point is, in Professor Wilson's opinion, the most desirable characteristic of a structural steel. Such a steel permits plastic deformation to occur at the yield point without an appreciable increase in stress and thus enables the steel to be fabricated and erected without serious injury. The shock absorbing capacity of a member depends upon its geometrical characteristics as well as upon its ductility, said Professor Wilson, and fatigue failures are not likely to occur in riveted members providing the members contain no unusually severe stress raisers. Experience, however, is not sufficient to justify a similar statement relative to welded members of carbon steel or to welded or riveted mmbers of low alloy steel. Tests are needed to determine age embrittlement of steel subsequent to plastic deformation; the effect of the velocity at which strain occurs upon the stress strain relation of steel, particularly at low temperatures; and the fatigue strength of riveted and welded connections.

New sanitary knowledge

Under the general direction of chairman Arthur D. Weston, chief engineer of the Massachusetts State Department of Health, the sanitary engineering division provided one of the most stimulating programs ever held by this group. A symposium on dewatering, drying and incineration of sludge, conducted by Dr. Willem Rudolfs, chief, department of water and sewage research, New Jersey Agricultural Experiment Station, was one of the highlights. An interpretative summary of the symposium which provided a roundup of latest practices, will be published in an early issue of *Engineering News-Record.*

A contribution of special merit was presented by Dr. P. C. Stein of Massachusetts Institute of Technology, who reported studies on the mechanism of filtration of water through sand. By constructing a miniature filter, $\frac{3}{16}$-in. in width and less than an inch in height, which could be attached to a microscope, he was able to observe two-dimensional flow. Visual observation supplemented with still and motion picture photography revealed what took place in the filtration process, and made it possible to formulate mathematical equations of the mechanism. This pioneer work goes a long way in supplying factual evidence showing that the filtration process is largely one of "sticking" of suspended particles to the surface of the sand grains.

Untried sewage treatment processes or those with which experience was limited were not approved for installation at military establishments, according to Samuel A. Greeley, consulting engineer, Chicago, and E. Sherman Chase, consulting engineer, Boston, who reported on the design of sanitation facilities. Activated-sludge plants were not looked upon favorably, they said, and chemical precipitation did not receive approval because of operating costs and the possible shortage of chemicals under war conditions. Recalling that the paucity of data from World War camps constituted a serious handicap to those charged with the design of sanitation facilities in the present emergency, they pointed out that reliable data is now being obtained and cataloged at all army posts; to make certain that intelligent records are kept, trained civilian personnel have been assigned to operation of treatment plants (for complete design details of army treatment works, see *ENR*, Mar. 27, 1941, p. 479).

Outstanding contributions, representing in some cases the work of many years, were made in committee reports submitted to the division. Among these was the final report of the committee on the advancement of sanitary engineering, submitted by chairman Charles Gilman Hyde, of the University of California; here was outlined recommendations for education and training as well as an appraisal of opportunities in the field. The committee on salvage of sewage, of which A. M. Rawn, chief engineer of the Los Angeles County Sanitation District, is chairman, submitted an informative statement on the possibilities and limitations of by-product recovery. And the committee on sewage treatment, under the leadership of Langdon Pearse, sanitary engineer of the Chicago Sanitary District, provided an authoritative review of new developments in the art.

The history and status of litigation involving diversion of water from Lake Michigan through the Illinois waterway into the Mississippi River, was also reviewed by Mr. Pearse, who pointed out the relation of this to the problem of sewage disposal in the Chicago Sanitary District. Completing the program of the division was a progress report on the Delaware aqueduct by Roger W. Armstrong, deputy chief engineer, Board of Water Supply, New York.

Soil testing practices

In the Thursday morning session of the soil mechanics and foundations division, M. Juul Hvorslev, research engineer, Cambridge, Mass., outlined the basic requirements of drive sampling. Diameter of samples should be from 1 to 3 in. for exploratory sampling, and 3 to 6 in. for undisturbed sampling. Length-diameter ratio of the sampler should be 6 to 15, depending upon the soil, but should provide room for disturbed soil and unintentional overdriving. The area ratio or ratio of cutting edge area to cross section of sample should be kept to a minimum and the sampler should be designed for 0.75 to 1.5 percent inside clearance. Finally large vents for escape of water should be provided, and the sampler should provide for use of liners when the sample is not preserved in the sampling tube.

Thomas E. Stanton, materials and research engineer, California division of highways, announced that 170,000 lin. ft. of samples obtained with a 1-in. sampler proved very valuable for highway work in his state. For depths up to 50 ft. in not too dense a material, the cost was 15 to 30¢ per ft. and for firmer soils 30 to 50¢. Use of a 2-in. sampler has also proved highly successful, and practically undisturbed samples with this equipment were obtained at depths of 100 to 200 ft. at a cost of $0.75 to $1.50 per ft.

In discussion, Frank E. Fahlquist, senior geologist, U. S. Engineer, described the sampling methods used by the Providence district office, one of the most interesting involving the freezing of the lower part of the sample to form a temporarily immovable plug. A piston-type sampler with a 3-in. Shelby tube inside a 6-in. casing is used, and samples are obtained at a cost of $8.50 per ft.

In an illustrated talk titled "Relation of Undisturbed Sampling to Laboratory Testing," P. C. Rutledge, professor of soils mechanics at Purdue, pointed out that compressive strengths determined from tests on specimens cut from large cubes taken by hand are, for all practical purposes, equal to the compressive strengths of completely undisturbed soils. Also that compressive strengths of samples slightly disturbed during sampling may be considerably less than the compressive strengths of completely undisturbed soils. Professor Rutledge concluded that undisturbed sampling and laboratory testing of such samples are worthwhile provided: (1) care is taken that samples undergo an absolute minimum of disturbance; (2) differences between test specimens and soil in nature are understood and can be evaluated; and (3) test results are applied with an understanding of their limitations and the limitations of the solution methods.

In the Thursday afternoon session of the soil mechanics and foundation division meeting, E. R. Fadum, instructor in civil engineering, at Harvard, discussed improvements in testing soil and urged that greater attention be paid to evaluating the effect of the time interval between obtaining and testing the sample. T. A. Middlebrooks, senior engineer in Washington, D. C., with the U. S. Engineers, pointed out that testing alone will not be of maximum value until test conclusions are checked in the field. He also stressed the importance of the time interval in shear tests, citing studies of a

Montana blue clay where the shear strength was not a minimum until a $1\frac{1}{2}$-hr. loading interval was used. Another factor considered important in shear tests of clay is the excessive hydrostatic pressure that builds up in such soils. Mr. Middlebrooks reported that the U. S. Engineers are investigating the triaxial shear method in cooperation with M.I.T., Harvard, and the U. S. Waterways Experiment Station, Vicksburg, Miss., but the direct method will not be abandoned until more work has been done to take care of the extra hydrostatic pressure with the triaxial method.

Possibilities of standardization in the testing of soils were discussed by Prof. G. P. Tschebotareff, Princeton University, who proposed a manual of recommended procedure in place of setting up standards. Because test technique is not developed sufficiently, standardization might retard the development of better test methods and equipment, in his opinion.

Construction operations

Pine Camp in Northern New York and the Delaware Aqueduct tunnel under the Shawangunk Mountains were the subjects of Construction Division papers. Daniel B. Niederlander, vice-president, John W. Cowper Co., revealed that despite 34 deg. below zero temperatures and three shifts operating seven days a week, the Pine Camp work cost only about $5\frac{1}{2}$ percent more than would be expected if it had been carried out as a normal job under much more ideal conditions. Mr. Niederlander pointed out that one of the most unusual construction features was the use of kerosene lanterns in place of salamanders to heat the concrete in several thousand poured footings.

In discussion, both Edward P. Palmer of Senior and Palmer, and David G. Aronberg, vice-president, Caldwell-Wingate Co., spoke in favor of fixed-fee contracts for rush defense work.

In his paper on the construction of a 15-mi. section of the Delaware Aqueduct tunnel Fred W. Stiefel, chief engineer, Samuel R. Rosoff, Inc., described the difficulties encountered from methane gas, faults and heavy inflows of water. (See *ENR*, July 21, 1941, p. 150.)

Hydraulic data

In a symposium on hydrology of elements contributing to floods Merrill Bernard, principal hydrologist of the U. S. Weather Bureau, discussed the maximum rate at which air currents might produce precipitation over a specific area; W. W. Horner, consulting engineer, St. Louis explained the relatively new theory of infiltration capacity of the land in speaking of the relations between rainfall and stream channel inflow; and Gail A. Hathaway, of the Chief of Engineers office, Washington, D. C., spoke on flood prediction by flood hydrographs, basing his discussion on the two successive floods in the Saluda Basin in 1929.

Penn Turnpike experiences

Operation experiences of the first year on the nation's longest toll highway were given by T. J. Evans, vice chairman of the Pennsylvania Turnpike Commission. The 160 miles of highway are divided into six maintenance divisions, and principal maintenance work is confined to the winter months. Roads are plowed by three to five units operating one-way plows in tandem; ice-cutting equipment has been successfully used; and 30,000 tons of untreated cinders were scattered on the road during the first winter. Tolls of \$2,729,000 were collected during the first year at ten interchange stations, with the start of the second year indicating a continuing increase over the original estimate. Discussion brought out the statement that truck traffic volume is off somewhat from the summer's high, an expected seasonal slump, but that the hauls average longer so that truck toll income for December, 1941, is 35 percent more than for December, 1940. Questioned as to the cause of accidents, Mr. Evans stated that sleep was suspected in some instances, running up under trucks had occurred and some cases were unexplainable. He mentioned instances where ice had formed in grooves under the fenders and prevented turning the wheels.

McLaughlin Air photo

Ahead of schedule and 30 percent complete

Herman Gardens, Detroit's \$8,000,000 defense housing project, finally got under way about the 15th of June last year, after many difficulties were experienced, with the awarding of an entirely new contract to Cauldwell-Wingate Co., contractors of New York and Detroit. Originally started as a low-cost housing job, the project was later qualified as a defense housing development with a P-19-d, A-2 priority rating.

The contract calls for completion within 420 days; to date the project is 30 percent complete and construction is well ahead of schedule.

The site of the project is on the outskirts of Detroit but within the city limits. In the above illustration, downtown Detroit can be seen in the background. In addition to 2,150 apartments in the 235 dwelling units, the development includes an administration and community building, a central power plant, two garages and a maintenance building. The power plant will house four 600 hp. boilers for heating and for supplying domestic hot water.

The apartment units are two stories high and of brick masonry construction. About 60 percent of the structures have pitched roofs, roof framing being of 18 gage steel made in the form of a Fink truss. The truss is provided with nailing slots for the reception of wood sheathing which is covered with tile. The remainder of the buildings have flat slab concrete roofs with a projection of about 1 ft. beyond the brick walls.

The floors are of the "Gibraltar" type with the concrete slab screeded to water level $\frac{1}{4}$ in. below the finished floor grade and dolomite chips distributed evenly over the surface, then rolled with a 300 lb. roller and troweled three times. After this monolithic mixture has sufficiently hardened, it is ground and polished in the usual terrazzo manner.

New York Sewage Works Association backs public works programming

Shortage of materials makes it impossible for New York City to continue sewage plant construction. C. R. Velzy elected president

A resolution putting the New York State Sewage Works Association squarely behind the efforts of the National Resources Planning Board in furthering a public works program was unanimously adopted at the 14th annual meeting of the association in New York City on January 23, and thus placed this organization in the forefront of those who recognize the importance of public works construction in the post-war period of readjustment. Specifically mentioned in the resolution was strong support of Senate Bill 1617 (and its companion measure HR 5638), which would authorize the making of federal advances to states and cities for preliminary study and design of projects.

Also adopted was a resolution favoring passage of HR 5676, a water pollution control bill, which would make available grants-in-aid to industries as well as municipalities for construction of waste treatment facilities. This bill provides for control measures to be administered by a special board created in U. S. Public Health Service, which would coordinate its functions through existing state health department organizations.

Army sewage problems

The technical program featured a paper on army camp sewage problems by Charles H. Capen, principal sanitary engineer and Lieut. Howard S. Montin, both of the New York District, U. S. E. D. They pointed out that actual sewage flows in camps in this area far exceeded the original design assumption of 70 gal. per capita per day, and in some instances reached 135 gpcd.; as a result a figure of 100 gpcd. has been adopted for design of new installations. Visitors over weekends and holidays produce unusual peaks of flow, a condition not observed in World War I, when automobile travel was not so universal.

Grit chambers and mechanical screening devices were said to be highly beneficial as an adjunct to treatment, because sand and other materials find easy access to camp sewers. Installation of individual grease traps at mess halls also has been very helpful in preventing large quantities of grease from reaching treatment tanks where it is difficult to handle.

Plant construction curtailed

New York City will not undertake any new treatment plant construction during the war period because of shortages of building materials, declared William L. Sylvester, assistant engineer, department of public works of that city. However, a stepped up design program is under way, so that work can be started immediately in the post-war period. Five treatment works, with a total capacity of over 200 mgd., are now under construction, but it is impossible to estimate when they will be finished.

Sewer construction problems at Lockport, N. Y., were described by W. R. Drury, consulting engineer, Shoecraft, Drury and McNamee, Ann Arbor, Mich. A method of combatting stream pollution by "accelerated re-aeration"—a system of adding oxygen by bubbling air into the flowing water at selected points—was proposed by R. G. Tyler, professor of sanitary engineering, University of Washington, Seattle.

Colonel Wm. Hardenbergh, chief engineer of the Army Sanitary Corps, revealed that a program of mosquito control started last April at 197 camp sites was responsible for a 60-percent reduction in malaria cases, as compared with camp experiences in the last World War. Colonel Hardenbergh made an appeal for sanitary engineers to join the Army, saying that authority had been given to add 350 men to his organization who will be commissioned as officers.

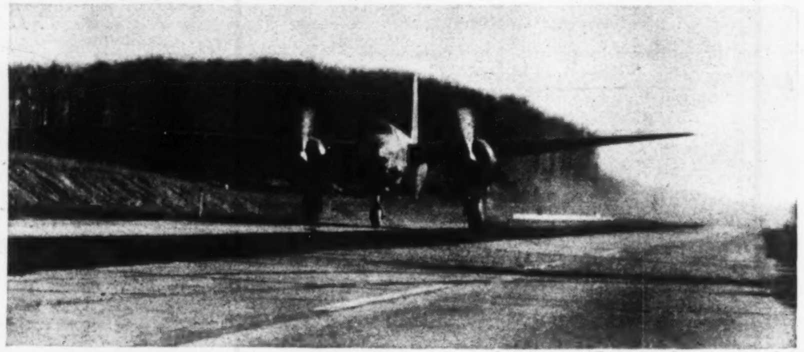
Succeeding Herbert H. Wagenhals, of Syracuse as president of the association for the coming year is Charles R. Velzy, works superintendent, Buffalo Sewer Authority. L. L. Luther, commissioner of public works, Freeport, L. I., was elected vice-president. Arthur S. Bedell, of the New York State Department of Health, was continued in office as secretary-treasurer. Gordon M. Fair, professor of sanitary engineering, Harvard University, was awarded the Kenneth Allen Memorial plaque for his paper analyzing the formation and decomposition of sludge deposits in streams.

Sanitary engineers wanted by the Army

Authority has been given to add 350 men to the personnel of the Sanitary Corps of the U. S. Army, at least 80 of whom will be commissioned as first lieutenants. Applicants must have a degree in civil or sanitary engineering, and at least four years experience in sanitary or public health work. Maximum age limit is 37 years. A first lieutenant, with dependents, will receive a salary of $3,152. Application should be made to the War Department, Office of the Surgeon-General, Washington, D. C.

Stamford sewage plant

In the *Jobs of the Week* section of the Jan. 15 issue (p. 78) it was incorrectly stated that W. Raisch, New York City, was architect on the sewage disposal plant for Stamford, Conn. Leon E. Tuttle, city engineer, reports that Solomon and Keis, of Troy, N. Y., are the architects, as well as engineers, on this project.



Pennsylvania Turnpike Commission photo

Attack bomber takes off from Pennsylvania Turnpike

The Pennsylvania Turnpike was used as a runway last week for a 20A attack bomber which had been forced down in an adjacent field. The plane was slightly damaged in landing and after repairs was towed to the highway and across an improvised bridge over the side ditch to the road.

The reflectors, normally in the center and on both sides of the highway, were removed from the center lane for a distance of 1½ miles to provide a clear and ample runway. The Turnpike then presented two 24 ft. lanes of concrete with a 10 ft. median strip and 10 ft. shoulders on each side to give a clear flight strip of 78 ft.

Highway traffic was halted three miles from the start of the run to assure its being at a safe distance. Smaller planes have landed on the Turnpike in an emergency but this is the first time it has accommodated a bomber.

OBITUARY

Charles A. Shea, 58, president of J. F. Shea & Co., construction engineers, and of the Oregon Shipbuilding Corp., died Jan. 25 at San Francisco, Cal. Mr. Shea's firm was engaged in construction of Boulder Dam, and many other important construction projects including tunnels for the water supply system of New York City and Baltimore, Md.; the Golden Gate and San Francisco Bay bridges, Grand Coulee Dam, and drydocks at Pearl Harbor.

Fred Eugene Foss, 79, professor emeritus of civil engineering at Cooper Union, New York, N. Y., and secretary of the school's engineering faculty for 24 years, died Jan. 18, at Bethesda, Md. Mr. Foss joined the Cooper Union faculty in 1909 as head of the department of civil engineering, and was responsible for the creation and development of the institution's material testing and hydraulic laboratories. He retired in 1938. He had formerly served for eight years as a civil engineering examiner for the New York Municipal Civil Service Commission. Before his appointment to Cooper Union he served from 1907 to 1909 as professor of civil engineering and head of the department at the Carnegie Institute of Technology. From 1893 to 1907 he held a similar post at the Pennsylvania State College.

William J. Backes, 62, consulting engineer for the Boston & Maine Railroad Co., died Jan. 20 at Boston, Mass. Mr. Backes was a graduate of Sheffield Scientific School of Yale University, and had long been identified with railroad engineering work. In 1926 he was named engineer in charge of maintenance for the Boston & Maine, later to become chief engineer. He retired in 1936 but was retained as consulting engineer.

Harold R. Paskett of Tarrytown, N. Y., former right-of-way engineer for the Westchester County, N. Y. Engineer's Office, died Jan. 22 at Eastview, N. Y.

James T. Anderson, 39, for the past four years employed as industrial engineer with the North Carolina Department of Conservation and Development, was killed in an automobile accident Jan. 14 near Raleigh, N. C. Mr. Anderson had just been appointed state director of the Office of Production Management for North Carolina.

Charles H. Rogers, 62, engineer, died Jan. 22 at Montgomery, Ala. He was formerly claim engineer with the North Carolina State Highway and Public Works Commission.

Robert B. Norris, 61, general superintendent of the Fraser-Brace Engineering Corp., in charge of building the $30,000,000 Keystone ordnance works, at Geneva, Pa., died Jan. 23, at Meadville, Pa.

Alfred E. Putman, 56, vice president of the MacDonald Engineering Co., Chicago, died Jan. 6 at River Forest, Ill.

W. J. Smither, professor of structural engineering at the University of Toronto, died Jan. 18 at Toronto. A graduate of the University of Toronto in 1904, Professor Smither had engaged in hydraulic engineering practice at Vancouver, B. C. and at San Francisco, Cal., before returning to the University engineering staff in 1911.

John F. Lynch, 62, superintendent of construction for the Louisville, Ky. Water Co. since 1935, died recently at Louisville.

E. M. Stevens, 71, retired civil engineer of Hyde Park, Vt., died Jan. 15 at DeLand, Fla. Prior to retirement in 1932, Mr. Stevens was chief engineer for the Missouri Portland Cement Co.

Bayard T. Lamborn, 63, former chief inspector in the structural steel division of the New York Central Railroad for 37 years, died Jan. 7, at East Orange, N. J.

CONTRACTS AND CAPITAL

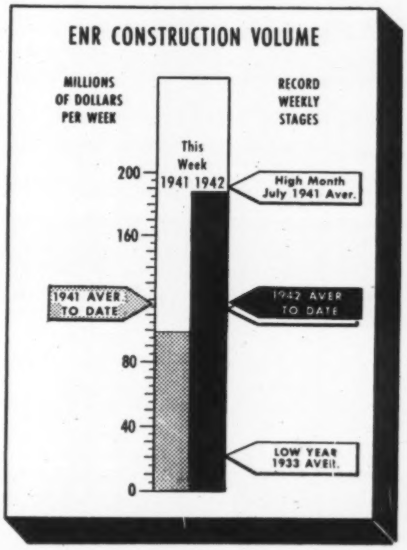
Engineering Construction awards for the week, $221,694,000, climbed sharply to the highest weekly volume reported since August 7, 1941. They are 74 percent above a week ago, and 124 percent higher than in the corresponding week last year. Public construction, also the highest since last August, is up 69 percent compared with a week ago, and 232 percent above a year ago. Private awards are 172 percent higher than in the preceding week, but 54 percent lower than in the 1941 week.

The week's high volume brings 1942 construction to $628,780,000, an increase of 7½ percent over the five-week period last year. Private awards, $51,121,000, are 71 percent lower than in the period last year, but public construction, $577,659,000, is 41 percent higher as a result of the 81 percent gain in federal work. State and municipal awards, $80,559,000, are 40 percent below last year.

Increased emphasis on military building construction boosts the public building volume to the highest peak since August 7, 1941, and shipway and airbase awards boost unclassified construction to its highest level since July 10, 1941. In addition to these two classes of work, waterworks, sewerage, bridges, industrial and commercial buildings gain over a week ago; and bridges, commercial buildings, and earthwork and drainage top their respective 1941-week values.

New capital for construction purposes for the week totals $55,481,000, a gain of 368 percent over the volume reported for the 1941 week. The current week's new financing is made up of $52,990,000 in state and municipal bond sales, and $2,491,000 in corporate security issues.

New construction financing for the year to date, $559,914,000, tops the $93,988,000 for the five weeks of 1941 by 496 percent.



CONTRACTS

(Thousands of dollars)

	Week Ending Jan. 30 1941	Week Ending Jan. 22 1942	Week Ending Jan. 29 1942
Federal	$27,947	$109,717	$187,231
State & Municipal	33,688	11,599	17,307
Total public...	$61,635	$121,316	$204,538
Total private..	37,199	6,324	17,156
TOTALS	$98,834	$127,640	$221,694
Cumulative			
1942........	(5 weeks)......		$628,780
1941........	(5 weeks)......		$584,549

Note: Minimum size projects included are: Waterworks and waterways projects, $15,000; other public works, $25,000; industrial buildings, $40,000; other buildings, $150,000.

NEW PRODUCTIVE CAPITAL

	Cumulative 1941 5 weeks	Cumulative 1942 5 weeks
NON-FEDERAL	$93,988	$109,914
Corp. Securities....	33,282	24,565
State & Mun......	47,043	74,049
U.S.H.A. loans	12,043	......
R.F.C. loans	1,620	11,300
FEDERAL	......	$450,000
TOTAL CAPITAL ...	$93,988	$559,914

ENR INDEX NUMBERS

Index Base = 100		1913	1926
Construction Cost...	Jan. '42	267.63	128.65
Building Cost.......	Jan. '42	217.12	117.37
Volume	Dec. '41	217	95

EDITORIALS

VOLUME 128 NUMBER 5

January 29, 1942

Marching Orders Needed

THERE IS A FEELING ABROAD among engineers and contractors that the Army and Navy are not moving fast enough in getting the construction phase of the victory program under way. No doubt military officials, even though they are working punishing hours, concur in that view. We can't work too fast! But someone in Washington should take this problem in hand and get action out into the open where it can be seen, felt and appreciated. Construction is the spearhead that comes before planes, powder, guns and ships, and advantage should be taken of an attitude that is enthusiastic enough to find fault with its progress. It is not only that idle engineers and construction men represent wasted manpower; their idleness at this time threatens success to the President's goal of 56 billion dollars of war supplies in the twelve months beginning next July. That is nearly 5 billions a month, or several times what we are doing now. Unless the necessary new production facilities are ready to operate by July, the task becomes immeasurably harder, for if the first few months fall behind schedule, the budget rises to 7 or 8 or 10 billions a month. And we might not be able to do that much. Competent production officials say the 56 billion total can be attained "if we get the breaks." The only way to get the breaks is to make them, and the first one can be made now by giving the construction industry its marching orders, in full and in force.

Self-Imposed Saving

DON'T USE CRITICAL MATERIALS where a substitute will serve as well, even though you have or can get a high priority rating. No formal order to this effect has been issued, but its wisdom can hardly be questioned. Back in the early days of the defense effort, getting a high priority and using it developed into a great competitive sport; responsibility for saving critical materials was up to the other fellow, who couldn't get a priority. Things are different today, and every unnecessary use of a critical material must be regarded as waste. The Maritime Commission recognized this when it contracted for concrete boats. The USHA recognized it in eliminating copper and zinc from its specifications. The Army and Navy are beginning to use timber in place of structural steel. Some engineers and contractors have voluntarily embraced substitute materials. Thus a good beginning has been made, but the practice should be universal. It is to high priority users that we must look for further savings of critical materials.

Government Contracts Clarified

THE RIGHTS OF CONTRACTORS holding construction contracts with the federal government have been clarified by two recent decisions of the U. S. Court of Claims. These two decisions, summarized in this issue, should help contractors by reducing the number of instances in which an arbitrary or overzealous contracting officer puts a "heads I win, tails you lose" interpretation on doubtful clauses in government contracts. They will also strengthen the position of contracting officers who attempt to be fair in their interpretations, and in the end will be beneficial to the government by eliminating many of the uncertainties that now make contractors bid high to protect themselves against the hazards that have surrounded government contract work in the past. Contractors will do well to study these decisions in detail. The precedents they establish or amplify go far beyond the government work to which they relate.

Prefabricated Housing

ANNOUNCEMENT that FWA is embarking on a program for building 42,000 prefabricated houses has led to speculation as to whether Detroit is among the some fifty locations selected for the projects. The speculation is not unnatural in view of the celebrated Currier case wherein the FWA decreed that prefabricated houses would not be allowed on a defense housing project near Detroit, on the grounds that it would be built by CIO labor and thus upset labor conditions in the building industry. A fair conclusion would be that the "hot potato" represented by the Currier case was abruptly cooled by the attack on Pearl Harbor and that the "labor angle" is now more favorable. If this is so, it is good news. Some day, sheer economics of house construction will admit prefabricated units to the building industry and, in view of our present need for speed and efficiency, that day should not be postponed. The adoption of house prefabrication is just as inevitable as was the adoption of linotypes over the bitter protests of old-time printers who erroneously believed their livelihood threatened. Just as the printing industry now employs many times the workmen required in the old hand-set days, some day the building industry will likewise employ many times the workmen now used in costly hand methods. Houses, then, like automobiles today, will represent sound value at a reasonable cost. The FWA program is thus not only a means for providing defense housing quickly but an entering wedge for a system that will raise the efficiency of post-war housebuilding. It deserves sympathetic support from all sides.

True to Tradition

BATTLING BRAVELY and intelligently against superior forces, the small garrisons of Marines on Wake and Guam Islands proved true to the tradition of their arm of the service, long before they were forced to give up. That they were aided in their stand by the construction forces at these outposts is also a part of the story, as is the fact that these civilian forces also had traditions to uphold. Twenty-four years ago, in the opening months of our participation in the first World War, American engineers engaged in building a railroad behind the British lines, dropped their picks and shovels and took up arms from fallen British soldiers to help check a German breakthrough. These men were part of a regiment of construction men who had been given some military training to fit them for just such an emergency. The men at Wake and Guam went there with no such preparation. Their brave and largely unheralded stand alongside the Marines, therefore, sets a new standard of service in which the whole construction industry may take justifiable pride.

Tough Steel

TOUGHNESS VS. BRITTLENESS, an old point of discussion in the field of structural steel, has had little attention in recent years. The oldtime bend tests for steel quality, which were toughness tests, have largely fallen into disuse, and practice has drifted rather steadily toward harder material, less ductile and tough than the soft steels formerly favored. In the light of such a trend, Prof. Wilbur M. Wilson's paper before the structural division of the Am. Soc. C.E. last week, in which he emphasized the value of ductility in structural steels, assumes first-order significance.

Ductility, coupled with a well-defined yield point, provides shock resistance, permits plastic deformation at the yield point without appreciable increase in stress, and allows rough handling during fabrication and erection. In brief, ductility goes a long way toward assuring toughness, a property of steel that current developments are bringing back to renewed importance.

One of these developments is the trend toward greater use of constrained or redundant types of structure, rigid-frame bridges and continues girder and truss structures, for example. A second development, no less important, is the increased use of welding.

The advantage of redundant structures, of course, lies in the mutual support of their parts, which leads to increased safety. But in order to assure this mutual support the several parts must be able to adjust to each other by virtue of their ductility, or else they must be so tough as to suffer no injury from local overstrain. Ductile steel is, therefore, safer and more economical than hard steel, even though the latter has the higher tensile strength. For like reason a welded structure calls for tough, ductile material, because its locked-up stresses and unavoidable constraints require the same kind of adjustment and automatic relief of overstrain.

In early days, strength and toughness were in a measure opposed qualities in structural steel; higher strength entailed the penalty of lower ductility and resistance to distortion. The modern steel-making art, fortunately, is better able to combine toughness with strength. It is, therefore, important that in seeking for economy through stronger steel the structural engineer should not fail to consider the value of ductility, with a view to safety as well as ultimate economy. And as a part of this consideration, it would be well to take into account Prof. Wilson's recommendations for additional tests to determine three types of information—age embrittlement subsequent to plastic deformation; effect on the stress-strain relation of the velocity at which strain occurs; and the fatigue strength of riveted and welded connections. A steel which will resolve these questions satisfactorily can truly be said to have the very desirable quality of toughness.

ENGINEERING NEWS-RECORD

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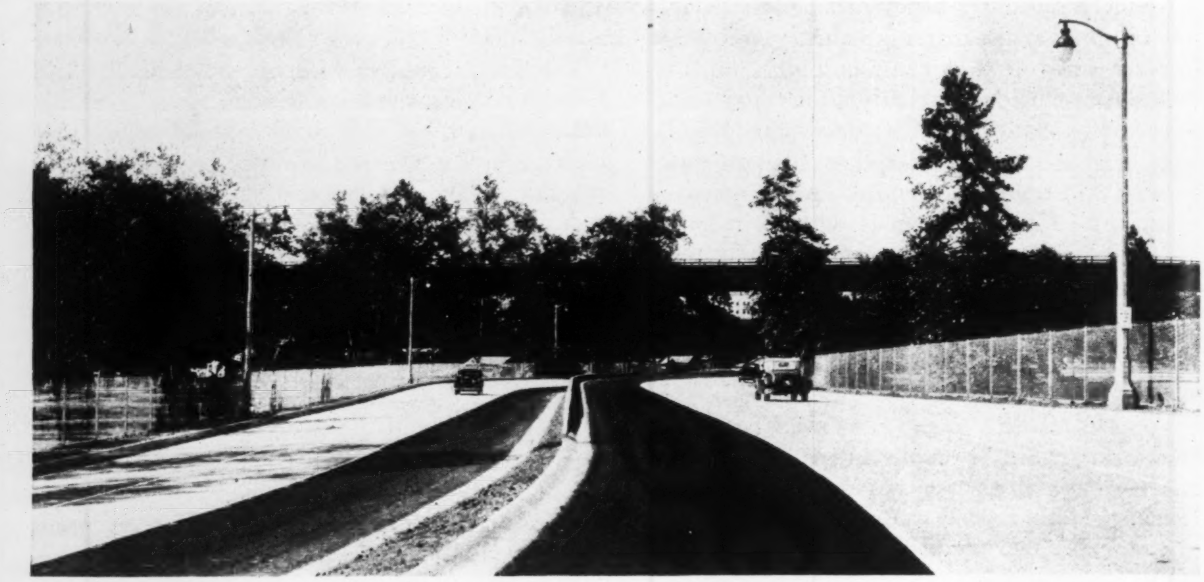


Fig. 1. Unavoidably sharp curves on the Arroyo Seco Parkway resulted in the design of a special type of median-strip curb for curves that are banked to facilitate maintenance of uniform speeds on the parkway.

Divided Highways in California

Fred Grumm
Engineer of Surveys and Plans
California Department of Public Works, Sacramento

Contents in Brief*—California with over 200 miles of divided highways has evolved several types of design for median strips and for curbs and has developed principles to be applied in acquiring right-of-way and to the spacing of crossovers. The state has a freeway law that checks encroachments on the capacity of divided highways.*

TODAY THERE ARE over 200 miles of divided highway on the California state highway system. With the exception of a few landscaped parkways in cities, the greater part of this mileage has been built in the last five years. Our records show that the divided highway was first actively considered for rural areas in 1931, but it was 1934 before any were constructed to meet modern traffic requirements.

Design and construction practices have varied considerably, but the variation has been caused by fitting the design to conditions peculiar to the individual project rather than by new developments in design outmoding previously constructed projects. Perhaps the biggest advance has been the increase in one-way lane width from 20 to 23 ft. in the four-lane divided highway. It cannot truthfully be said that there has been a recent trend toward wider median strips. One of the first projects, constructed in 1934, has a 20-ft. median strip; and a 17-mile-long project constructed in 1938 has a 50-ft. separation. An appreciable mileage of narrow median-strip highways has been constructed but principally these have been projects involving expansion of existing paved roads to multiple-lane capacity within existing rights-of-way or where such rights-of-way could be expanded only slightly without incurring tremendous additional expense.

If there is any definite trend in the design of divided highways in California, it is toward the protection of the investment by the acquisition of egress and ingress rights through application of our freeway law. Too often a modern highway, divided or otherwise, has reached an early obsolescence because of adjacent commercial development turning an ordinary country roadside into a ribbon city with its accompanying traffic hazards and congestion.

Types of median strip

There are at least eight types of median strip that have been used in California, most of which are still serving their purpose (See Fig. 2). Portland-cement concrete curbs of the type illustrated in Fig. 2(a) are considered preferable for narrow division strips. The purpose of the median strip is to separate opposing lines of traffic. A narrow strip is easily invaded and crossed. To compensate for this shortcoming, some positive prohibition against such crossing is necessary. A curb offers effective prohibition. This type of curb is constructed with recess faces to increase visibility at night.

An easily mountable rolled type curb, Fig. 2(b), was tried on a few projects but has been discarded from general use on narrow separations because it was subject to abuse by indiscriminate crossing and "U" turning. This indiscriminate crossing not only resulted in a traffic hazard but also increased maintenance cost by damaging the landscaping and sprinkling system, and carrying dirt onto the pavement.

The raised bar median strip illustrated in Fig. 2(c) has been used to a considerable extent. The earlier bars were shaped into arrows, as illustrated in Fig. 3. The present type bars are without embellishments, with dimensions that vary from ¾ to 3 in. in height, 6 to 8 in. in width, and from 10 to 20 ft. longitudinal spacing. The greater height and smaller spacing are used at the approach to a curbed median strip or at the intersections where a more positive indication is desired. While the 6 in. recess curb is generally preferred for the narrow median strip, the raised bars have proven advantageous on high fills and marshy areas where unequal settlement might cause ponding against a curbed strip. They are also advantageous for stage construction over an existing pavement where the old crown might create a drainage problem if curbs were used. Their chief disadvantages are that they can be crossed at will, and their maintenance cost is high.

The rolled type strip in Fig. 2(d) has no advantage over a flush strip delineated with double white stripes. If the roll is made high enough to be a positive indication, it becomes a hazard to traffic, is more expensive to build and is a maintenance problem.

The special type of median strip shown in Fig. 2(h) was designed for a special condition on the Arroyo Seco Parkway in Los Angeles, where it was necessary to use comparatively sharp curvature at a location where the vertical and horizontal limits for construction were previously established by external conditions. This type of curb made it possible to achieve a desired greater superelevation to meet design speed and thus allow uniform speed to be maintained throughout the project.

Curbs for wide strips

The above types are all adapted to use for narrow median strips. The recessed and rolled curb types are equally adaptable to the wide separation. If curbs are to be placed bordering a wide median strip (more than 20 ft.), the rolled type is probably more appropriate. The erect curb, Fig. 2(a), is more positive in effect, therefore more appropriate on the narrow separation. With the wide strip, affording in itself protection against rapid crossing, the more moderate type of curb, presenting perhaps slightly less hazard to the vehicle, is preferable.

The wide type, Fig. 2(e), and the two-level type, Fig. 2(g), are in common use in California. There is very little difference between the two types with the exception that on the two-level section with maximum slopes it is desirable to use a berm or guard rail for the protection of traffic on the high roadway. In such cases, a 5-ft. shoulder is constructed along the inside edge of the pavement. Two-foot stabilized borders are constructed immediately adjacent to the pavement to prevent undue shoulder settlement which is both a hazard to traffic and a contributing cause to pavement edge failure. Curbs are rarely used on the wide separations except at intersections, especially those requiring channelization. In these locations the curb is installed to outline the traffic islands and is carried sufficiently far along the median strip to serve as a guide and warning to traffic.

On the wide median strip, an inexpensive barrier railing is being used to prevent indiscriminate left or "U" turning across the median strip until such a time as the planting, if any, is developed enough to be a sufficient deterrent in itself. For these two types, where drainage is carried into the separation, the runoff is generally carried longitudinally in the strip to a convenient cross-drain, where it is discharged by means of a drop inlet.

The type illustrated in Fig. 2(f) uses a bituminous mixture instead of portland-cement concrete for curbs. This type has not been used sufficiently to establish its worth. The concrete type should prove generally preferable because it is more positive and should be much less expensive to maintain. The first cost of the bituminous curb would be slightly less than the concrete curbs. The apparent advantages of the bituminous type curb is that it is adapted to stage construction and the combination of curb and gutter can be modified at will for drainage purposes.

With the exception of the "bituminous roll" strips, Fig. 2(d), which is no longer used, every type illustrated is suited for some particular set of

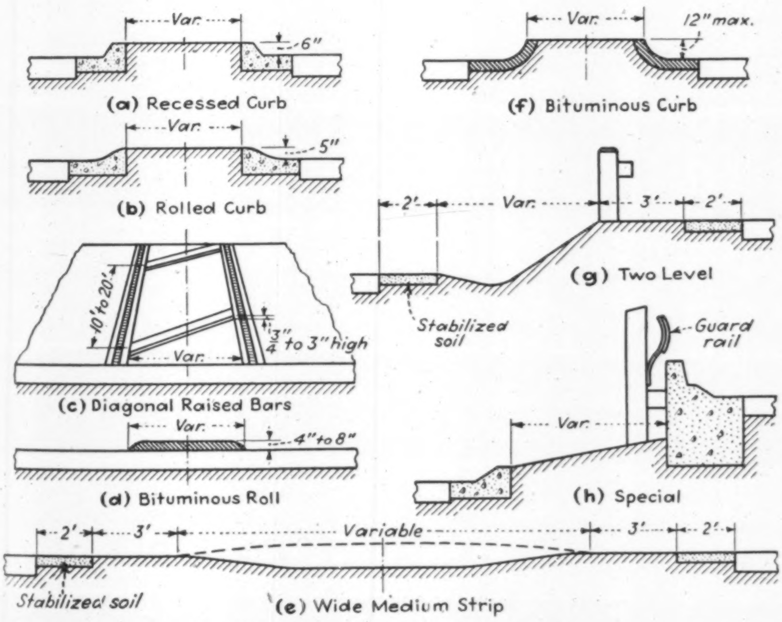


Fig. 2. Eight types of median strips are in use in California, each being designed to meet some special condition or as an improvement on an earlier type.

conditions. Therefore unless controlling conditions are specified, such as unlimited right-of-way, controlled rights of egress and ingress, etc., it is impractical to state which type is preferable except as stated above.

Width of median zone

If there is heavy turning and cross-traffic, other things being equal, a wide median strip is preferable. With fixed right-of-way limits, the width of median strip might be established on the basis of marginal friction rather than medial and intersectional friction. That is, if there were heavy on-street parking threatening the capacity of the outer lane because of frequent maneuvers, it might be desirable to decrease this friction by widening the shoulder at the expense of the median strip, thus increasing the medial and intersectional friction. A thorough study of the present and anticipated traffic pattern is necessary before such determinations can be reasonably made.

In the case of freeways with private property shut off from egress and ingress and with crossroads carried under or over, there is little advantage to a wide median strip other than the elimination of headlight glare. On such a road the narrow strip has the advantage of economy in amount of right-of-way and in length of grade separations.

We are now using a four-lane divided highway with a wide median strip as a stage construction for an ultimate six-lane divided highway with a narrower separation and grade separations. An initial width of median strip of from 30 to 32 ft. will provide ample protection for crossing and turning traffic under most conditions. When congestion appears, this width allows the addition of two lanes taken from the median strip and still leaves sufficient width for traffic requirements and pier protection at overpasses. This design makes for economy in both initial and ultimate construction.

Crossovers

Once the type and width of median strip are selected, one of the most difficult problems is the location of crossovers. At first this item was not given particular attention beyond attempting to keep the number of crossovers to a minimum. The cry that went up from those owners of commercial establishments not having a crossover provided directly opposite their place of business was disconcerting at the least. "The division strip is cutting us off from 50 percent of our source of income!" they claimed, ignoring the fact that their competitors across the street would be subject to the same loss of income, or conversely the same gain of income. When a special opening was granted one owner, it furnished ammunition for the others to back up their demands. Thus the initial trend in median-strip design was toward extermination of the strip, hence the necessity for a definite policy toward the establishment of crossovers was clearly indicated.

To back up our claims that the owners were not suffering a loss of business because of the median strip, before-and-after studies were made over comparable periods on several divided highways. To assure an unbiased study, comparisons were made on the basis of the owner's sworn sales-tax statements. The resulting evidence exceeded expectations. Own-

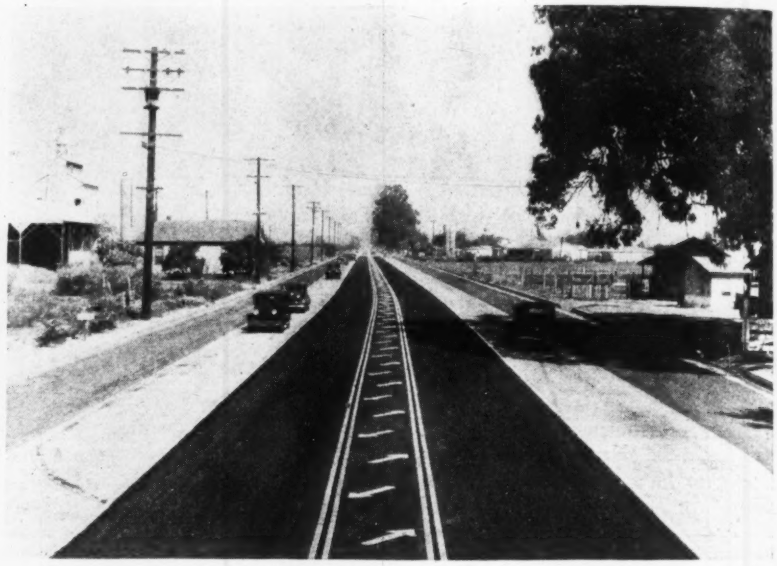


Fig. 3. Raised bars on median strips are used to discourage travel on or across the strips. Arrows were used initially, but have been superseded by plain bars. At intersections and at all other points where a more positive indication is desired, higher bars are used.

ers that had claimed losses as high as 60 percent were proven to have had gains of up to 140 percent. On one project, there was an increase from ten to eighteen service stations in a three-year period covering the time before and after the installation of the division strip. Of the ten original stations, only one showed a decrease in business.

With the array of data produced, we felt justified in establishing our policy of limiting crossovers to intersections with existing public roads and at intermediate intervals of not less than one quarter of a mile where such intermediate crossovers are of value and benefit to general traffic.

It should not be assumed for a moment that divided highways are being advocated because of increased business to abutting owners. We must, therefore, face facts and admit that frontage access is already so well established on many miles of our highway system that to attempt its elimination would in most cases be out of the question even though unlimited funds were available. It is usually more economical to build a parallel facility than to buy sufficient additional right-of-way along an existing developed highway for a modern improvement. Thus in many cases we are faced with the necessity of accommodating as modern a highway as practical within a limited right-of-way, and it is important to incorporate every possible safety feature, the most important of which is the median strip.

Where a parallel highway is to be built, or where an existing highway with undeveloped frontage is to be improved, we have in many cases been acquiring the rights of egress and ingress. This has been done under authority of the California Freeway Law enacted by the State Legislature in 1939, which permits condemnation of access rights on roads declared freeways by the California Highway Commission.

The acquisition of access rights insures that whatever type of highway is built will be protected for all time from obsolescence due to ribbon development. It is felt that protection of right-of-way is one of the most important features of design. It is a simple matter to change the type of median strip, but to regain a modern highway facility after it has been enveloped by a ribbon city is a major problem. The only entirely satisfactory solution is a relocation on a freeway basis.

An article summarizing nationwide trends in divided-highway design is to be published in the issue of Feb. 12.—EDITOR.

Alternates for Zinc Coatings

The following is condensed from a bulletin prepared by E. F. Hickson of the National Bureau of Standards for the Protective and Technical Coatings Section of the Office of Production Management.—EDITORS.

USE OF ZINC as a protective coating for metals has been greatly curtailed for use in any manner except for direct war material necessities. No alternate material has all the desirable properties of the ordinary hot-dip galvanized or zinc-coated surfaces on steel, including resistance to abrasion and corrosion, weathering, and freedom from cracking and peeling. However, for specific applications certain paints, presently available, can be listed as satisfactory coating materials.

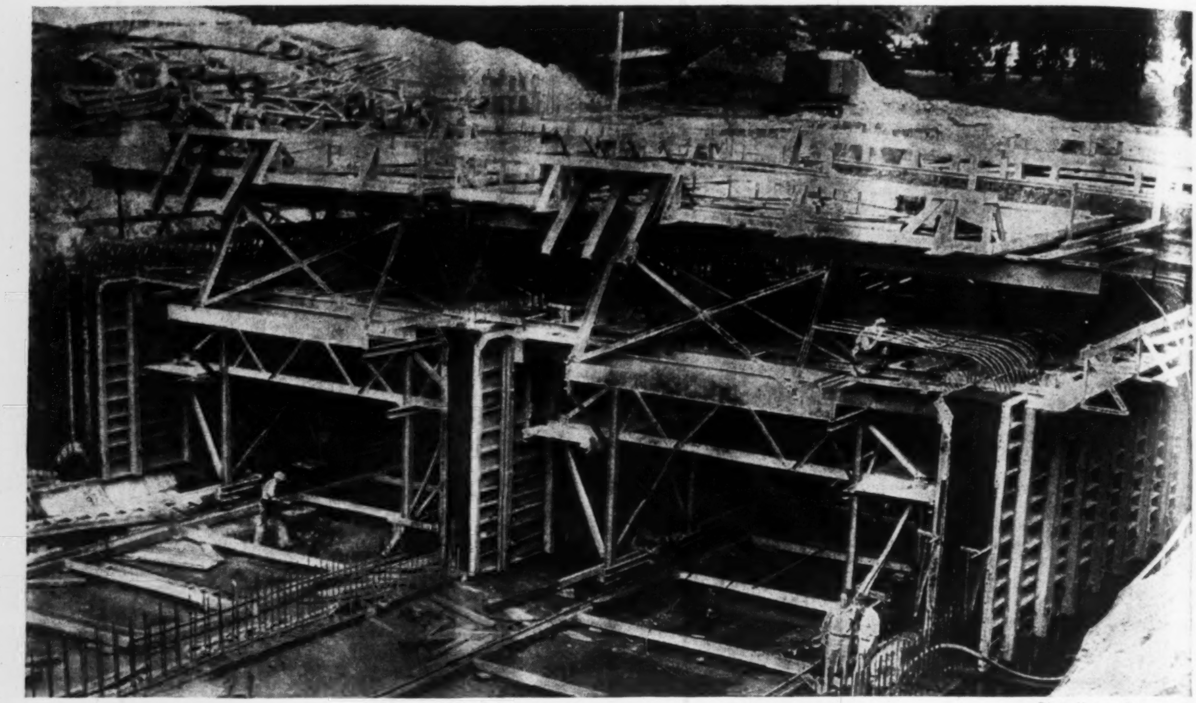
Exterior Structural Steel—For structural steel such as that used in transmission towers where zinc-coated material has normally been used, the following is recommended. After priming the clean surface with a rust-resisting primer such as red lead paint (Federal Specification TT-P-86), basic lead chromate paint (TT-P-59), blue lead paint (TT-P-20), etc., use a finish coat of gray paint, or any other tint, conforming to specification TT-P-36a or TT-P-156. If chalk-resistant titanium oxide is specified, TT-P-101a, or War Department Cantonment Paint may be used tinted in any desired color. If color is not important, dark paints such as iron oxide (TT-P-31) or black (TT-P-61) will be more durable than white or light tint paints.

Interior Structural Steel—In plants where light reflection from the structural steel is desired, the following procedure may be used. Apply a priming coat of quick-drying red lead paint (Procurement Division Specification No. 358), or similar rust-inhibitive primer, followed by either two coats of eggshell flat white paint (Fed. Spec. TT-P-51a) or gloss white enamel (TT-E-506a). The enamel will be more water-resistant and more durable.

Exterior Sheet Metal—For exposed sheet metal, one government agency specifies either phosphat-treated steel or terne plate. The sheets are specified as 26-gage, phosphate-treated, and given immediately a dip-coat of mineral oxide paint baked on at a temperature of 250 to 300 deg. F. Sheets shall be given one coat of red lead and oil (TT-P-86) before placing.

Subsoil or Underwater Exposure—Bituminous base coatings are suggested in lieu of zinc-coated steels subjected to subsoil or underwater exposure. Solutions of either asphalt or coal tar in a volatile distillate are primarily intended for use as primers on surfaces that are subsequently to be coated with a hot application of asphalt. This material, known commercially as black or liquid asphaltum, bituminous paint, etc., is also used on surfaces where black coating is desired and surfaces that will not be subjected to the action of heat or sunlight. A cold mastic type of coating, which consists of asphaltic materials (with or without fatty oils) and mineral filler thinned to a heavy brushing consistency with a volatile solvent (SS-R-451), is intended for use in the repair and coating of asphalt and metal roofing and for application to concrete, masonry, and steel structures as a dampproofing and protective coating.

Within practical limits the protective value of a paint film is roughly proportional to its thickness. Thus for exterior exposure the safest procedure is to apply three coats of good paint at a rate 500 to 700 sq.ft. per gal. per coat. Where exposure conditions are particularly severe it is suggested that two coats of primer and two coats of the finish paint be applied. The surface to be painted should be dry and free of all rust and scale.



Blaw-Knox Co. photo

Fig. 1. Twin conduits for the Park River at Hartford will prevent floods and carry a new street.

Putting a River Underground

Contents in Brief—*Pile foundations through soft muck, large traveling forms for concrete construction and use of a "triple" concrete pump with discharge line carried on the boom of a big crane are highlights of building a twin 30x19-ft. pressure conduit to carry the Park River underground through Hartford, Conn. An access road from the new Connecticut River bridge and bypass highway will enter the business district over the conduit.*

A Twin Pressure conduit about 5,600 ft. long, with the top of its intake structure 54 ft. above the discharge invert, is being constructed to carry the waters of the Park River through downtown Hartford and prevent high water on either the Park or Connecticut rivers from flooding the city as they have done in the past. The conduit is part of an extensive flood control project for this key defense city, which also includes high dikes and floodwalls.

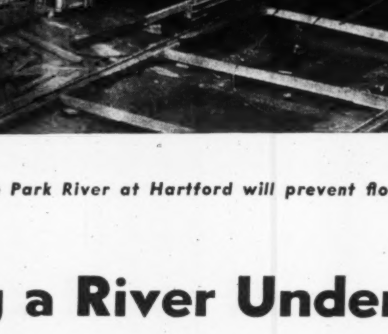


Fig. 2. Downtown area of Hartford, Conn. indicating the location of the Park River and the conduit that will convey it to the Connecticut River.

Unusual subsurface conditions, existing all along the Connecticut River, required pre-excavation of columns of muck before piles could be driven to support the discharge end of the conduit. Forms used are heavy steel frames mounted on travelers. Concrete placing departs successfully from the conventional, with a paver, mounted on a high frame, supplying concrete to a double and a single-cylinder pump, which force the concrete through a single line to point of placing. The discharge end of the pump line is supported under the boom of a crawler crane, which forms a bridge for pumping across the wide trench. These are among the features that make this job one of the most interesting flood control operations in the country.

The old Park River bisected the city, following a steep and circuitous route through Bushnell Park in the center of Hartford, to discharge into the Connecticut River. This left the city open to flooding by rapid flowing waters when the Park River was in flood and by backwater from the Connecticut when the latter was high. The new construction, which places the river underground in a conduit that runs in almost a straight line from inlet to outlet, eliminates both of these sources of floodwaters.

As designed, the conduit will pass a flood of 15,000 cfs. with the Connecticut River at El. 38, maximum stage of the record 1936 flood; of 20,000 cfs. with the Connecticut at an intermediate flood stage of El. 28; of 9,500 cfs. (much greater than the record flood of 5,600 cfs.) with the Connecticut at El. 48, the top of the riverfront floodwalls. The inlet is located far enough upstream that high banks on both sides permit building up the intake to El. 50, which will hold waters from the Park River in the channel and permanently prevent backflow from the Connecticut River from spreading into the city. Since the drainage area contributing to the conduit discharge is 76 square miles, while the drainage area of the Connecticut River above Hartford is 10,480 square miles, there is small likelihood that the peak discharge of the two rivers will occur simultaneously.

A lucite model of the upstream end of the conduit was constructed to a scale of 1:30 at the Alden Hydraulic Laboratory of the Worcester Polytechnic Institute to investigate hydraulic flow conditions at the entrance, and in the curved section of the conduit just below. A model was also constructed of the conduit outlet, to investigate the conditions of discharge into the Connecticut River. (*ENR*, May 1, 1941, p. 709.)

The Hartford Bridge Commission, assisted by the city and the state highway department, is building a four-lane highway over the top of the conduit from a point on the waterfront, thus providing a much-needed traffic artery in a badly congested area. The roadway will be constructed below the grade of existing streets, which will be carried across on bridges similar to that in Fig. 3.

Initial construction operation was building a new outlet for the Park River in a straight line with the conduit rather than following the old, longer channel. To exclude the waters of the Connecticut River during construction, it was first necessary to build a 330-ft.-long cofferdam outside the edge of the conduit discharge apron to El. +10. A single-line, braced sheetpile wall was selected because it required only half the sheetpile driving and pulling and none of the fill and subsequent dredging that would be necessary for a rodded, box-type cofferdam.

Batter timber piles, 60 ft. long on 5-ft. centers were driven at an angle of about 18 deg., followed by vertical piles at the same centers with their tops brought to about El. +13. The piles were made into a brace, tied only above the water, and a longitudinal stringer was placed near the top to take the thrust of the water against the sheetpiles. Deep-web sheet-piling was driven to El. −38, which permitted a 7-ft. toehold in gravel. As the cofferdam was pumped out it showed evidence of probable movement so the bracing was reinforced by driving an additional batter and vertical pile between each of those first placed, making 2-ft. 6-in. centers for the final bracing.

Use bed of the Park River

It was necessary to divert the flow of the Park River into a flume along part of the new work. Square box construction, partly carried on piles, was used in the old channel just outside the construction limits of the new conduit. Through some narrow areas sheetpile walls were used for the flume with a floor made of concrete.

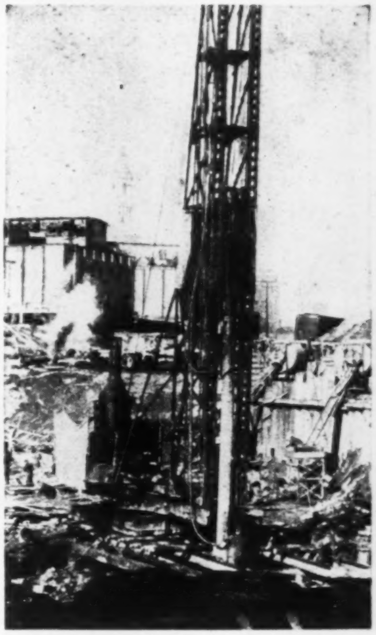


Fig. 4. Pre-excavator lifts column of mud from hole to permit driving piles without compacting soil.

Much of the new project is constructed in the river channel and required little excavation except in Bushnell Park, where a channel change required removal of earth to a depth of 30 ft., done in open cut. Piles are required to support the conduit through about the lower half of its length as it is located over a saturated varved clay, which extends from El. −14 to −31.

Bearing piles used are of the corrugated-shell, cast-in-place type, driven with a mandrel. No difficulty was experienced in driving, the average pile

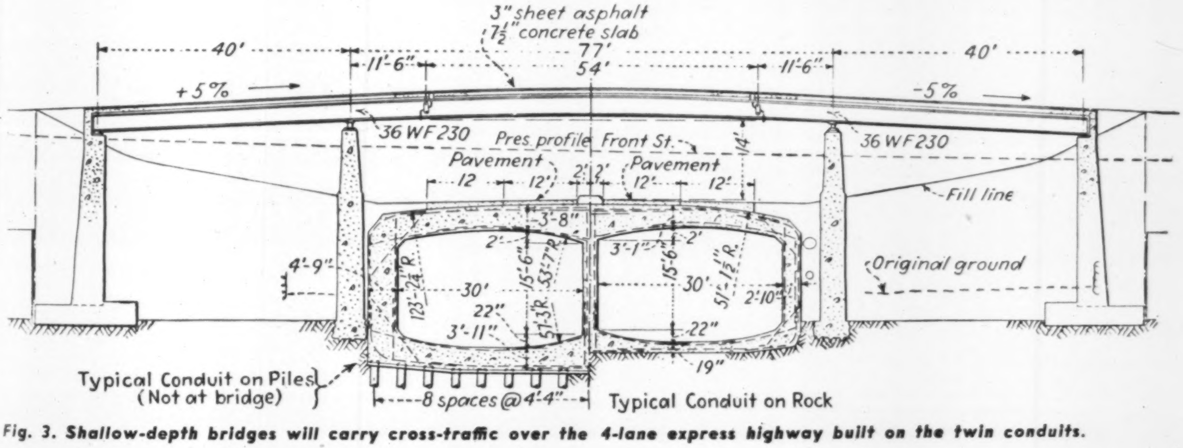


Fig. 3. Shallow-depth bridges will carry cross-traffic over the 4-lane express highway built on the twin conduits.

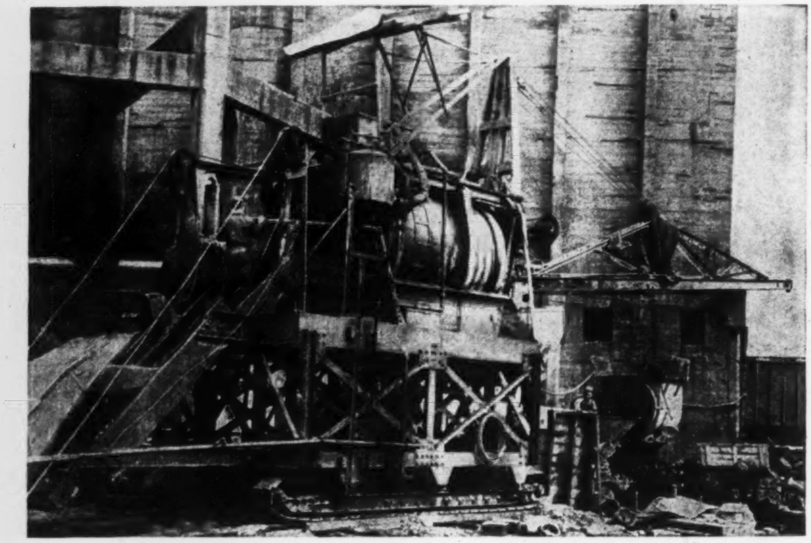


Fig. 5. Concrete is produced by a 34E double-drum paver on a high frame, which permits it to dump into hoppers of a single- and a double-cylinder concrete pump.

requiring only a few blows to force it through a stable top layer, following which it fell 17 ft. from the weight of the mandrel and hammer to a harder layer into which it was necessary to drive. After a number of piles were driven and the ground compacted by the displaced material, some trouble developed. Vibration and the compaction of additional driving caused movement of the driven shells, some of which had just been filled with concrete. The difficulty was apparently due to the flowing caused by disturbing the varved clay which was confined between the layers of stable material.

Effective relief was obtained by driving a 20-in. O.D. pipe with 1-in. wall thickness to the bottom of the clay, then putting a 20-lb. vacuum on the pipe shell with a vacuum pump and lifting the core of clay from the hole. The pipe shell was then swung away from the hole and the material dropped out by releasing the vacuum. Some soft material flowed into the hole during removal of the pipe and before a pile could be driven, but it apparently made little difference as the volume of material under the confining blanket was not further increased. After this method was adopted there was no further movement of the shells, but the operation of filling them with concrete was kept 30 ft. behind the driving to prevent any possible damage to the driven piles. This trouble was experienced only where piles were closely spaced.

General cross-sectional outlines of typical sections on piling and on rock are shown in Fig. 3. Construction joints are required at 40-ft. intervals with a copper waterstop used around each joint, including the top of the conduit, which is designed to run full with nearly a 50-ft. differential head from the high intake works to the outlet.

Concrete by paver and pump

An old coal supply yard with reinforced-concrete bins for material storage is being used as a plant for dry batching. Aggregates are trucked in from a producing plant set up by the contractor, and the cement comes by rail in hopper-bottom bulk cement cars. Multiple-batch trucks haul dry material to the point of use.

Concrete is mixed in a special high frame 34E double-drum paver designed to dump material from the usual concrete spreading bucket into the remix hoppers of two concrete pumps. One pump is a large double cylinder machine pumping through the usual Siamese connection into an 8-in. pipeline. A smaller pump is also located so that its hopper can be filled from the paver and discharged into the same 8-in. pipeline through a special connection beyond the Siamese. These two pumps have handled 70 yd. per hr., although the average,

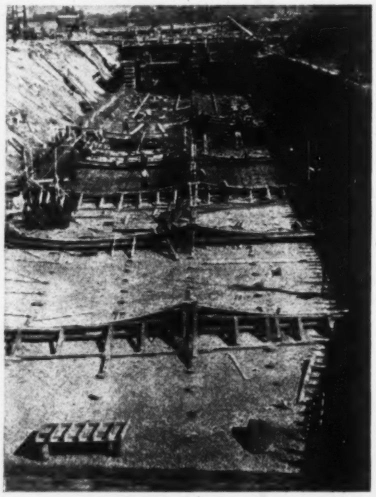


Fig. 6. Sequence of conduit building operations: after piles are driven, a 6-in. layer of lean concrete is laid over soft bottom; invert forms are set and filled alternately; wall and arch placing follows. Flume at right carries normal flow of river.

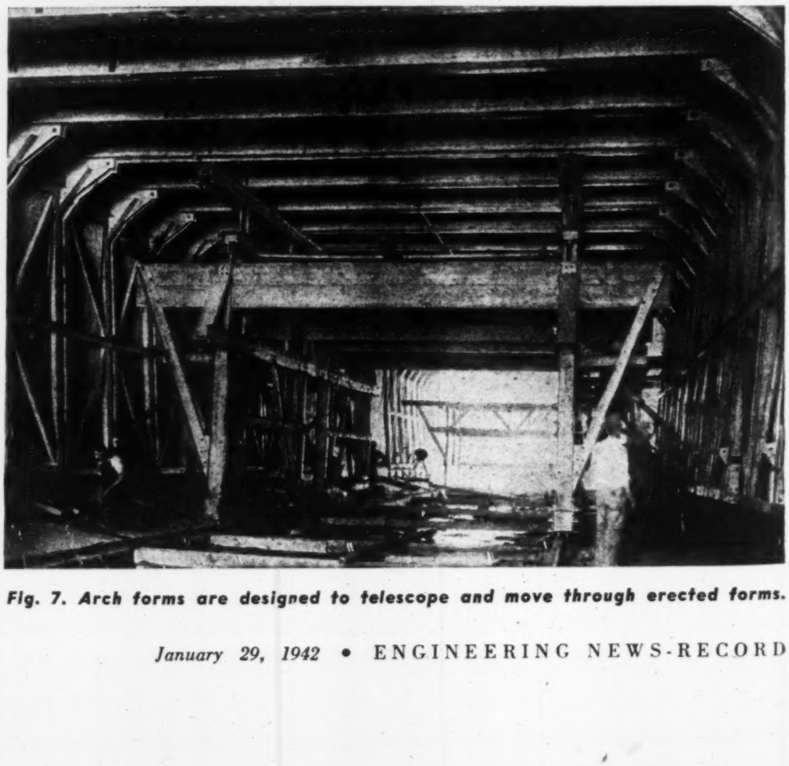


Fig. 7. Arch forms are designed to telescope and move through erected forms.

due to placing limitations, is around 50 yd. The paver and pumps are electric-powered, and one of the pumps is skid-mounted, so it is desirable to locate them in one place for several days' operation. Concrete placing operations, from invert to arch, are kept fairly close together so that all are within the pumping reach of the equipment. Concrete is generally placed in alternate monoliths with the intervening block placed as soon as they can be made ready after the stripping of forms from the first monoliths is permitted.

The problem of placing concrete over a wide trench, full of forms and equipment, was solved by ingenious use of a crawler crane equipped with a long boom. Operated along the top of the bank at one side of the excavation, with the concrete delivery pipe attached to the underside of the boom, the crane serves as a movable concreting bridge. A discharge point is provided at the tip of the boom and another about 30 ft. back from the end. For sidewall and arch placing, a counterbalanced full-circle swing chute directs the concrete to position as shown in Fig. 8. For invert placing, since the boom of the crane must be kept above the horizontal, the chutes are removed and 8-in. vertical pipes hung under the discharge points to control the fall of the concrete.

Concrete used contain 5.2 bags of cement per yd. in a 1:2.22 (sand); 2.35 (1-in. gravel); 2.35 (2-in. gravel) mix. A water-cement ratio of 6 gives a slump of about 2 in. and an average 28-day compressive strength of about 5,000 psi.

Invert paving

A 6-in. layer of lean (4.3 bags of cement per yd.) concrete was placed above the soft clay, where there was no natural layer of firm material, and on this the invert paving was laid. The paving varies in thickness from 1 ft. 7 in. to 3 ft. 11 in., depending on the material on which it is placed, the heaviest section being for pile foundation above clay and the lightest for conduit resting on rock.

A special templet built up of angles and channels is rolled to position on rubber tires over plank runways, and a steel screed is operated from it to get the exact surface shape of the invert, which is finished with wood floats. The concrete placing pipes hanging from the crane boom are each swung in a circle as required to distribute the concrete.

Traveling steel forms are used for the three vertical walls and for the arch. The vertical walls are about 15 ft. 6 in. high, the center wall having a slight fillet added at the top, at the contractor's expense, to match the outer walls in providing a convenient shoulder to jack the form against.

The pair of vertical forms for one outside wall and the form for one side of the center wall are attached to each of the two carriers as shown in Fig. 1. Originally both sides of the center wall were moved on one of the carriers, the other carrier being counterweighted to balance the overhanging load of wall forms on one side, but this was found undesirable. The forms are heavy and rigid; push-pull turnbuckles provide the means for accurate alignment and easy stripping; and heavy, lag-threaded bolts resist the concrete thrust. Two 40-ft. sets of panels for each tube are each provided with traveling supports which carry the forms ahead as soon as stripping is permitted. One set of forms is used to place alternate blocks and is followed by the other, which forms the remaining openings.

Ten 20-ft.-long sets of arch forms are used for each barrel and are designed to collapse and move forward through forms in place. The carriers operate on the rails used by the wall form carriers and are built so that two sections may be coupled together to move 40 ft. of arch form at one time to set the full monolith length permitted. The forms span the 30-ft. width of each conduit tube, being supported only on the steel frame set against the walls and held tightly to them by lag-threaded bolts inserted in the ties which first held the wall forms. Actual support is on ratchet lever screw jacks, which are kept from slipping on the sloping floor by setting them in a channel, with flanges up, and prevented from sliding by blocking against bolts placed vertically in the floor concrete.

The work is being done under a 1,050-calendar-day contract for $2,877,000, started in August, 1940, by B. Perini & Sons, Inc., Framingham, Mass. Al Lattanzi is superintendent and Geo. Phillips, engineer. Raymond Concrete Pile Co., New York, had the subcontract for furnishing and driving the 100,000 ft. of cast-in-place concrete piles that were required.

The entire Park River project will cost about $3,200,000, exclusive of roadways over the conduit. The project was designed by Metcalf & Eddy of Boston, Mass., for the Providence, R. I., District of the U. S. Engineer Department. Col. J. S. Bragdon. was district engineer during most of the work. T. S. Burns is chief of the Providence engineering division. R. E. Lee is the Hartford area engineer and J. A. MacAlarney is resident engineer on the Park River project.

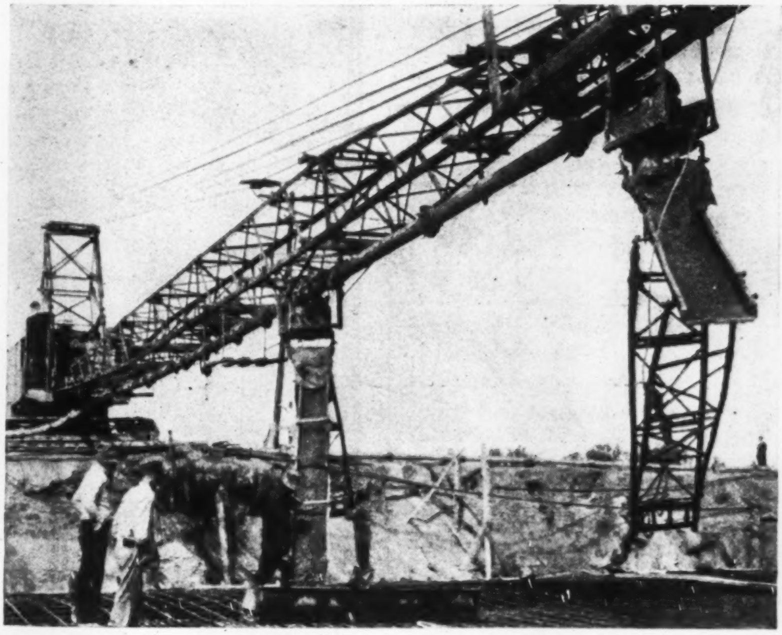


Fig. 8. Crane supports concrete pipeline and chutes which distribute concrete.

Signal Lamps for Night Surveying

Douglas L. Parkhurst
Chief, Instrument Division
U. S. Coast and Geodetic Survey

IN NIGHT SURVEYING the U. S. Coast and Geodetic Survey engineers use an unusual electric signal lamp upon which to sight when using a transit or theodolite. The development of surveyors' signal lamps by the Coast and Geodetic Survey has extended over a considerable period of years, and one of the earlier lamps made use of a burning magnesium ribbon fed by clockwork to give a continuous and brilliant flame. Acetylene lamps were also experimented with but soon gave way to battery-operated electric lamps equipped with large automobile headlight reflectors. This type is still used today, but with considerable modification.

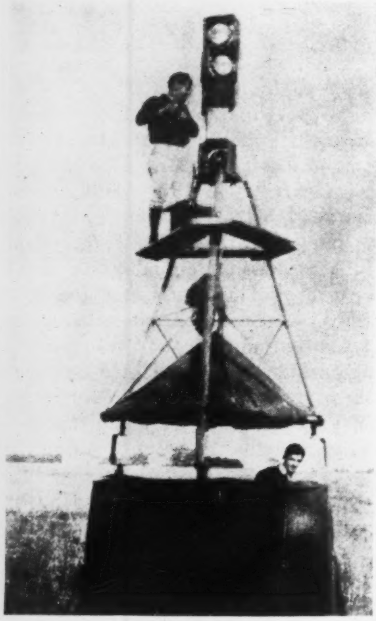


Fig. 1. Signal lamps are stacked to permit several theodolites to sight on the station simultaneously.

Early in the process of devising an electric lamp, a bulb was produced having a filament in the form of a very small coil located at the reflector's focal point and with the coil's axis lying along that of the reflector. This provided a powerful ray with a very small angle of dispersion, and lamps were soon in use that could be observed as far away as 50 and 75 miles, 152.7 miles for one line in Arizona being a record.

At the present time, three lamp sizes are in general use. The first is for short lines of a few miles and makes use of a flashlight headset as a reflector. A second has a reflector from a 5-in.-diameter automobile spotlight, and is suitable for most work now being carried on, while the third, having a 7-in.-dia. automobile headlight unit, is used for the longer lines. Basically, all three lamps are alike in that a bulb and reflector are mounted in a frame so that the reflector may be tilted in the vertical plane, and the entire lamp turned horizontally about the reflector's focal point. A slow-motion screw permits of accurate adjustment for tilt, and a pointer is provided to aid in directing the lamp's ray toward the observing station.

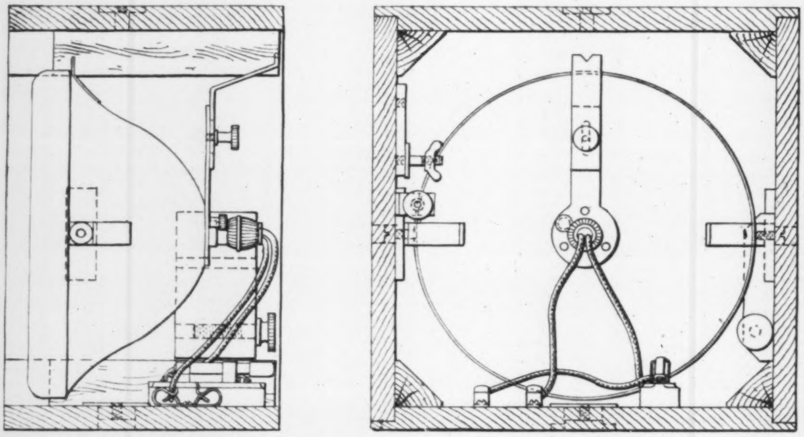


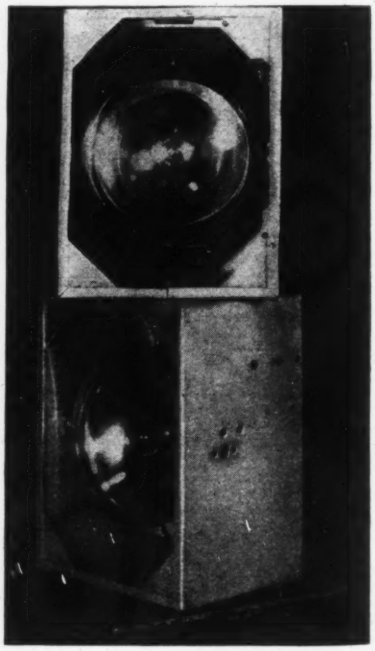
Fig. 2. Construction details of lamp with wood frame. This is the largest size unit.

The lamp frame carries centering plates at both top and bottom to allow two or more lamps to be stacked and properly centered upon each other so that more than one theodolite may sight upon the station simultaneously.

Most lamp frames are of seasoned mahogany, which has been found the most satisfactory because of its small tendency to check and warp. However, experiments have been conducted with metal frames, chiefly of sheet aluminum, and results have been quite satisfactory.

These lamps are all quite reasonable in cost, and give uniformly satisfactory performance. Nevertheless, additional development work is now required because automobile manufacturers are adopting the sealed-beam headlight, which makes reflector supplies hard to obtain, especially the larger sizes. Present indications are that a 5-in. reflector, now readily obtainable, with a somewhat higher voltage bulb, will provide a lamp with all the power required and plenty to spare.

Fig. 3. Lamps are mounted so that they can be rotated about the center line.



Bomb Tests of Materials and Structures

***Contents in Brief**—Data has been made available by the War Department as to the resistance of various types of construction under actual bombing. This information, which is considered of special value in providing civilian air-raid protection, is based upon extensive tests with several different types of bombs of various sizes.*

EXTENSIVE TESTS carried out under the direction of the Chief of Engineers, U. S. Army, to obtain specific information on the effect of aerial bombing on structures showed little protection is provided by some proposed types of construction. The work was planned as an aid in developing designs for air-raid shelters suitable for civilian protection. Funds were made available for the tests in July 1940 and construction work at the Aberdeen (Md.) Proving Ground was started in September 1940.

The tests were of two types, namely: (1) controlled tests, made by detonating bombs statically on the ground or in craters or bored holes to determine the effect of splinters and blast; and (2) tests using different size bombs dropped from various altitudes to determine the resistance of structures to actual bombing.

Wall panel experiences

In the first tests eleven wall panels, each 5 ft. high and 10 ft. wide, mounted on vertical wood frames and buttressed with sandbags, were spaced along the circumference of a 100-ft. circle at the center of which a 600-lb. demolition bomb was detonated. After the effects of this explosion were recorded, the panels then were rearranged in a 50-ft. circle and a 300-lb. bomb detonated at the circle's center.

General conclusions of these tests and acceptability of the different panel types follow:

Structural steel plate, 1 in. thick—This panel was the most resistant to blast and splinter. Although perforations occurred from a 300-lb. bomb at 25 ft., none occurred from a 600-lb. bomb at 50 ft. This suggests that the requirement of $1\frac{1}{2}$-in. steel thickness given in Table 4 of *Protective Construction Bulletin No. 1* for protection against blast and splinters (See *ENR* Jan. 1, 1942, p. 15) is conservative.

Brick wall, 12 in. thick—Resistance to splinters was satisfactory, but blast effect caused bond failure, particularly with a 300-lb. bomb exploding 25 ft. away.

Sandbags, 30 in. thick—Offered good resistance to splinters. Laying of sandbags is an important detail, and bags should not be more than half to three-fourths full of sand or earth and the open ends should be closed securely, such as by sewing. Bags should be laid flat with material evenly distributed and the courses lapped longitudinally and laterally, with each layer thoroughly tamped to form a good bond and to compact the material. A side slope of about 4 on 1 should be used for stability.

Structural steel plate, $\frac{1}{2}$ in. thick—Fair resistance to splinters and blast, but an additional thickness of steel or use of a supplementary material is necessary to prevent perforations from splinters flying from a 600-lb. bomb exploding at 50 ft.

Cinder block wall, 8 in. thick—Offered fair resistance at 50 ft., but blast and splinters practically demolished panel at 25 ft. Cores of the blocks could be filled with sand to provide additional resistance. It is probable that similar blocks of concrete filled with sand would provide greater degree of protection.

Brick veneer, 4 in. thick with sheathing and plaster—Panel not completely resistant to splinter perforations at 50 ft., and panel was damaged severely by blast and splinters at 25 ft.

Corrugated iron, No. 3 to 12 gages—Panel offered slight resistance to splinters. Little distortion caused by blast, although the panel was blown down.

Other panels—Plywood, asbestos-cement sheets, and wood panels were only slightly resistant to blast and splinters at 50 ft. They tend to shatter and disintegrate, thus making it inadvisable to use these panels to resist splinters.

Testing of shelters

Tests with air-raid shelters were also carried out to determine the resistance of several shelter types to: (1) bombs detonating after entering the earth; and (2) blast and splinters from bombs exploding on or near the surface. Demolition bombs of the 300-lb. and 600-lb. sizes were placed at different distances from the shelters and detonated statically with the effects recorded after each detonation.

An underground six-person reinforced-concrete box shelter (wall and roof thickness 8 in. and 3 ft. of earth over roof) is considered a satisfactory type, since it provides good resistance to a 300-lb. bomb exploding in a 12-ft. deep crater 10 ft. from the shelter and a 600-lb. bomb in a similar crater 30 ft. away. In turn, a six-person wooden shelter, which was enclosed with $1\frac{1}{2}$x8-in. sheathing all around and covered by 3 ft. of soil, offered little resistance. Construction of wooden shelters is advisable only where either time or materials preclude construction of better types.

A highly resistant type

A semi-buried, corrugated-iron, $6\frac{1}{4}$-ft.-diameter shelter 49 ft. long and designed for 50 persons, proved to be quite resistant when tested with 600-lb. bombs buried in the earth or placed in craters as close as 15 ft. and with 300-lb. bombs similarly placed at 10 ft. The adaptability of this type of shelter to fabrication, and the flexible and simple installation are characteristics which appear to make corrugated iron an excellent material for small shelters.

However, a semi-buried six-person shelter with arch roof and side walls of alternate plates of No. 8 and No. 10 corrugated iron and end walls of plywood did not prove satisfactory because of the weakness of the ends, although the roof exhibited good resistance. This structure, which was covered with a minimum of 2 ft. of earth, was tested with the larger bombs at ground level 25 and 50 ft. away and with the smaller size bomb on the surface 15 ft. away.

Tests of a semi-buried six-person shelter with an arch roof of 10-gage corrugated iron plate, vertical side walls of 2x6-in. wood sheathing, and laminated end walls of plywood plus a layer of No. 16 gage sheet iron, showed that this shelter was not entirely satisfactory when covered with a 1-ft. minimum thickness of earth and tested in much the same way as the shelter last mentioned. Replacement or strengthening of the end walls was seen necessary. The corrugated iron roof, however, indicated good resistance.

Most satisfactory shelter

One of the most satisfactory shelters tested was a six-person semi-buried shelter consisting of a 6½-ft. diameter cylinder of corrugated iron closed on the ends with 8-in. thick reinforced-concrete walls. This structure, covered with from 1 to 2 ft. of earth, was tested by exploding on the surface the smaller size bomb 15 ft. away and the 600-lb. bombs at 25 ft. In addition it was tested by dropping 100-lb. demolition bombs from an airplane. One of these hit 9.5 ft. away and another at 6.3 ft., but the shelter withstood the explosive forces satisfactorily.

Also tested was a six-person reinforced-concrete box shelter with 1-ft. thick side and end walls, an 8-in. thick floor and a 6-in. thick roof. The floor of this structure was at ground level and a 300-lb. bomb was detonated 15 ft. away and 600-lb. bombs at 25 and 50 ft. This shelter suffered serious structural damage, resulting in the spalling of the concrete and exposure of the reinforcing steel, as was expected for a structure without protection of an earth covering.

Actual bombing tests

In the second series of tests, bombs were released from airplanes to determine the effects of impact (using sand-filled bombs), and both impact and explosion (demolition bombs). The structure types tested were: (1) three typical reinforced-concrete buildings with different roof thicknesses; (2) a two-story, semi-buried reinforced-concrete shelter, which was supposedly bombproof, being built according to British specifications for such structures; and (3) an underground reinforced-concrete box shelter. In addition eight burster slabs, seven of concrete, varying in thickness from 1 to 3 ft., and one of sheet asphalt 4 ft. thick were tested.

Bombs released 4,000 to 12,000 ft.

General procedure in these tests was first to release sand-filled bombs of 100-, 300-, and 500-lb. weight at altitudes varying from 4,000 to 12,000 ft. The effect of each hit was noted and then the tests with explosive bombs were conducted by releasing 30-lb. fragmentation bombs and 100-, 300-, and 600-lb. demolition bombs at altitudes from 5,000 to 12,000 ft. Some of the latter bombs had instantaneous fuses, while the others were delayed-action bombs.

Each of the three reinforced-concrete buildings of the first group consisted of a roof slab, supporting columns, beams and footings. The structures differed in that the roof thicknesses were 5, 8, and 12 in., respectively, but were alike in that no floor slab was used and that the top of the roof slab was 15 ft. above the base of the column footings. Sand-filled bombs in landing on these buildings caused local damage and in every case resulted in perforation of the slab. Scabbing of the slabs was proportionately much deeper with the thinner slabs than with the thicker ones. Reinforcing bars, with a few exceptions, were not broken. This is believed to indicate that the concrete and reinforcing steel acted separately in resisting penetration of the bombs or that the bond between the concrete and the reinforcing is destroyed by the shock. The value of reinforcing in resisting penetration, therefore, is believed to be relatively small. The tests also showed that a large number of reinforcing bars is more effective than a smaller number of large bars having equivalent area, the greater bond apparently helping

Harris and Ewing photo

London workmen construct a reinforced-concrete blast wall at the entrance to a new air-raid shelter. Many surface shelters of brick may soon be scrapped and replaced by reinforced-concrete structures.

to resist the destructive forces and the concrete fragments being smaller.

Much shattering

Under actual bombing of the building prototypes a surprisingly large amount of shattering occurred to the concrete beams, and columns. To avoid this damage a protective covering of brick, which seems to suffer less shattering action, might be employed. Likewise considerable damage was caused by earth shock, nearby explosions moving or lifting the footings to such an extent as to severely damage the frame. Buildings should be designed, therefore, with continuous frame so that lateral movements of a footing and destruction of a column will cause minimum damage. Serious damage caused by bombs exploding underneath portions of the building prototypes also showed that damage from confined explosions is a major problem in protective construction. With the prototypes there were no walls to confine the explosion, but the concrete slabs in some cases were completely torn loose from the beams. Based upon the test results, the use of straight bars is recommended without attempting to provide for shear by bending up the bars at the quarter points.

Semi-buried shelter tested

One of the first shelters tested was of the semi-buried type or a shelter with one story above ground level and one below. The structure was divided into Sections A, B and C with the first having a 5-ft. thick roof, side walls 3¼ ft. thick above ground and 5½ ft. below that level and a 5-ft. thick basement floor slab. Sections B and C roof slabs were 3½ ft. and 2 ft. thick, respectively, with proportionately thinner walls and underground floor, while the floor at ground level was 1 ft. thick for all sections. The roofs and walls were designed as rigid frames and the upper 2 ft. in the case of the 5-ft. thick roof was considered as a protective layer only. The walls were designed for the maximum load that could be supported by the roofs.

Sand-filled bombs striking the semi-buried shelter produced only small craters, except where a bomb hit near the edge of the roof. In the latter case much more concrete was broken off, apparently due to less lateral support at such points as compared to the slab's center. This suggests concrete structures with rounded surfaces for greatest bombing resistance. Demolition bombs hitting the structure revealed that the 5-ft. thick roof slab resisted the effect of impact and explosion of 600-lb. bombs. However, no hits were made in the central portion of the slabs, but rather were immediately over the exterior walls, which resulted in some cracking in the wall directly underneath. A 600-lb. bomb striking the 2-ft. roof perforated this slab and exploded inside the structure's upper gallery and caused severe damage, as very heavy blast pressure resulted. This damage emphasizes the need for an adequate roof to resist direct hits. Serious damage from earth shock due to bombs landing near but not striking the structure also resulted.

Semi-buried shelters

The second shelter tested, supposedly bombproof, was buried under a 14-ft. thick covering of earth, which in turn was covered by a 2-ft. thick reinforced-concrete burster slab and then finally a 1-ft. layer of earth. This structure, designed in accordance with the British practice for resistance against a 300-lb. demolition bomb, had side and end walls 2 ft. thick, a 2½-ft. thick roof and a 3-ft. floor. There was no apparent damage to the shelter's main portion. Although it was feared that a bomb perforating the burster slab would cause serious damage, two bombs exploded in the ground about 6 ft. underneath that slab with but minor damage to a door of the shelter. However, the bomb hits were not directly over the central portion of the structure.

Bombs exploding in the soil nearby caused cracks in the ramp leading into the shelter and this cracking caused serious leakage of water into the structure, which verifies reports from abroad that underground structures are not suitable where there is a high groundwater table or where damage to water lines or sewers might cause flooding. Even if the structures are completely watertight before the bombing begins, they may be cracked by earth shock and become untenable due to flooding.

Effectiveness of burster slabs

Tests on burster slabs, which were placed directly on the ground, indicated that a 1-ft. slab was entirely inadequate in resisting the penetration of the sand-filled bombs, but that the 2-ft. slab resisted penetration of even the 500-lb. sand-filled bombs. There was some question, however, concerning the effect of the sand-filled bomb compared to the same shell filled with TNT; apparently the sand does not give the same support for the shell as does TNT. No definite conclusions could be drawn from the tests as to the effect of the concrete's strength and different types of reinforcing, but it is believed that the type of reinforcing is not a matter of great importance in penetration resistance. Although the penetration of the sand-filled bombs when striking the asphalt slab was greater than that with the concrete slabs, the asphalt's resistance was surprisingly great and the shattering less than with the concrete. However, the reduced damage to the bomb shell casing would seem to make this material less suitable than concrete for burster slabs.

One-foot burster slabs inadequate

Live bombs hitting the burster slabs also indicate that 1-ft. thick slabs are inadequate. For a 300-lb. demolition bomb the 2-ft. thick slab is adequate, and based on the brief data from the test and collateral information, the 3-ft. slab may be considered as being satisfactory in resisting the penetration of a 600-lb. demolition bomb. Severe damage to the burster slabs from bombs hitting in the earth near the edges of the slabs indicates that continued bombing might seriously reduce the effectiveness of these slabs by destructive attrition at the edge.

Required thickness for protection against instantaneous-fuse bombs was shown to be much less than for delayed-action bombs. Separation of the concrete in the plane of the expanded metal reinforcing used in some of the slabs indicates that this is not a satisfactory type of reinforcing. The use of welded wire fabric with a fairly large mesh, for example 6x6 in., appears much better. Also, it is not clear that the reinforcing is of any material benefit in burster slabs, except for the purpose of tying the slab together, and in preventing temperature cracks.

Added details of the tests described above are given in *Report of Bomb Tests on Materials and Structures*, a bulletin which may be obtained from the U. S. Office of Civilian Defense, Washington, D. C., at a nominal cost.

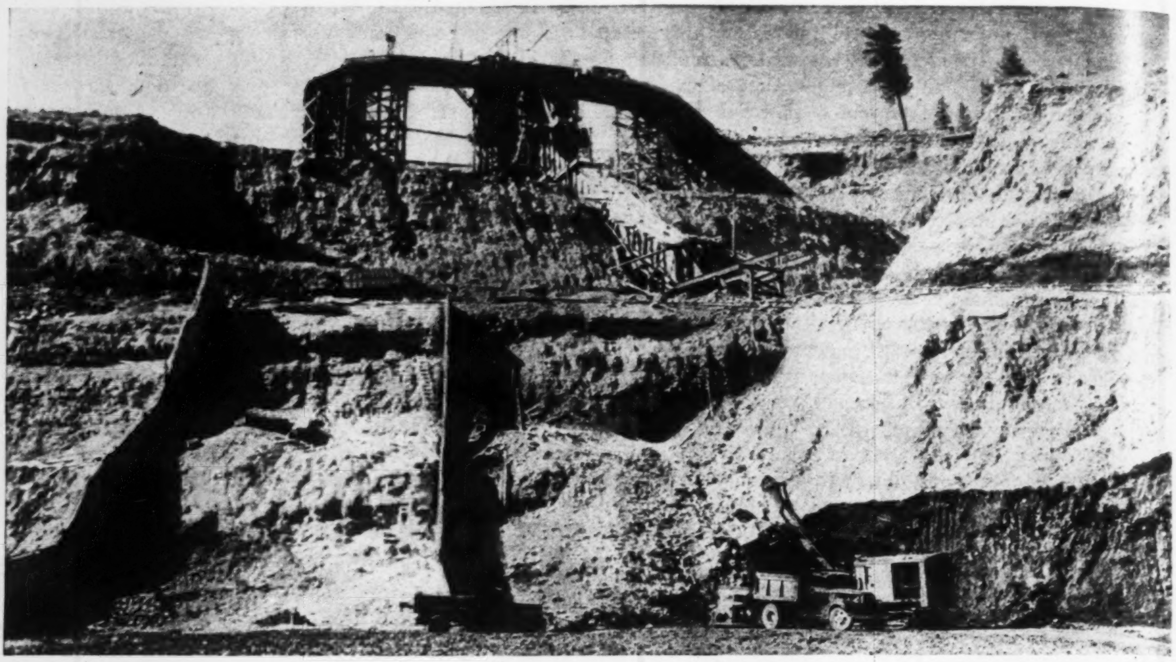


Fig. 1. Rock and earth for Green Mountain Dam are separated at this plant.

Processing Plant for Rock-Earth Dam

***Contents in Brief**—The contractor on the Green Mountain Dam in Colorado developed an unusual and effective processing plant for separating fines for the impervious fill section from rock and cobbles for the downstream portion, both coming from a glacial moraine borrowpit. The dam, part of the Colorado-Big Thompson irrigation and power project, will be one of the highest of its type in the world, 310 ft. from foundation to crest.*

HIGH ON THE MOUNTAINSIDE above the left abutment of Green Mountain Dam, under construction on the Blue River in Colorado as part of the Colorado-Big Thompson project of the Bureau of Reclamation, lies a deep deposit of glacial moraine, the source of rock and earth fill for an embankment that will be one of the highest of its type in the world. Getting the material from borrowpits to the dam is not only a problem of transportation down steep canyon slopes, but also one of separation into two main classes of fill—rock for pervious fill and fines for impervious rolled embankment. The contractor, The Warner Construction Co., of Chicago, combined transportation and processing with a downhill haul from pit to plant, gravity flow of materials through the plant where fines are separated from rock 3 in. and larger, and more downhill haul of the separated materials to the fill.

Design features

The dam, being built for a storage reservoir to compensate West Slope water users for water to be diverted through the Continental Divide tunnel to East Slope irrigation projects, will be a maximum of 310 ft. high from lowest point of foundation to crest (El. 7,960). The main body or central portion is rolled impervious fill with small section of semi-impervious rolled fill on each side; the down-stream section is dumped rock and cobbles of 3-in. minimum size. A 3-ft. layer of riprap will cover the upstream face. This face is a uniform slope of 3:1, except for a 40-ft. berm at El. 7,780, the top of the permanent cofferdam placed last year, which forms the upstream toe of the dam. From crest to El. 7,770 the downstream face has a slope of $2\frac{1}{2}$:1; then flattens out to 5:1. Slope of the contact between fines and cobbles varies, depending upon the proportion of materials coming out of the borrowpit. Present proportion indicates the dam will contain about 2,890,000 cu. yd. rolled fill and 1,360,000 cu. yd. of rock and cobbles, exclusive of riprap.

Processing plant

At the start of embankment placing last year, The Warner Construction Co. installed a huge traveling processing plant in the borrowpit. This rig consisted of receiving hoppers, vibrating screens and storage hoppers for fines and cobbles, all mounted on crawler treads. It was charged by a 5-yd. electric shovel, and was moved around the pit within reach of the shovel at all times. Separated materials were hauled to the fill in 24-yd. dump trucks, obtained from the San Gabriel No. 1 Dam in California, rebuilt and fitted with diesel engines.

This arrangement proved impracticable for three reasons: the portable processing plant was difficult to maneuver; under existing road conditions down the canyon slope, trucks were not suitable for the haul; and delays at the shovel and in moving the plant tied up the whole job. Early last fall the plant was moved to a stationary position near the bottom of the canyon near the upstream toe of the dam. For the remainder of the season trucks hauled pit-run material to chutes above the plant. Fines were at first hauled to the fill in tractor-scraper units, later bottom-dump tractor-trucks were used; rock was handled by truck. This layout was only temporary.

During last winter and spring the processing plant and hauling arrangements were entirely revamped. The plant was set high on the canyon wall, near the borrowpit, about on the axis of the dam. Top of plant is at El. 8,000, low enough for a downhill haul from the borrowpit, and high enough for downhill haul of processed materials to the dam except for topping out.

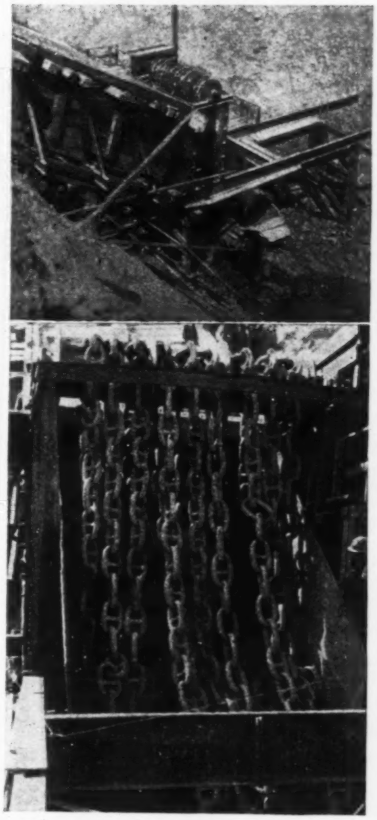


Fig. 2. Key to the processing plant is this chain feed at the bottom of the rock chute. By slowly rotating the endless chain loops, the flow of rock into waiting trucks is easily controlled.

At the pit the material is loaded into bottom-dump tractor-trucks by three shovels for a maximum haul of 2,000 ft. to the plant. Glacial boulders, too large for the shovels to handle or to pass through the bottom-dump gates on the trailers are cast aside, all other material is loaded as it is found. The trucks reach the top of the plant on a circular trestle, pausing only a moment to dump into a divided receiving hopper, lined with steel plate.

At the bottom of each of the two compartments of the receiving hopper is a 5x16-ft. reciprocating feeder, operating on an 8-in. stroke, 35 oscillations per min., set on a 10-deg. slope, and feeding into a chute. These chutes, 6 ft. wide at the bottom and flaring out to 7 ft. 10 in. wide at the top, are set on an angle of 35 deg. Their bottoms consist of heavy bar grizzlies, six bars to a chute, spaced for clear openings of 7 in. at the upper end and 10 in. at the lower end. At their lower end the grizzly chutes converge into a single large chute, 8 ft. 9 in. wide at bottom, 10½ ft. wide at top, set on a 30-deg. slope.

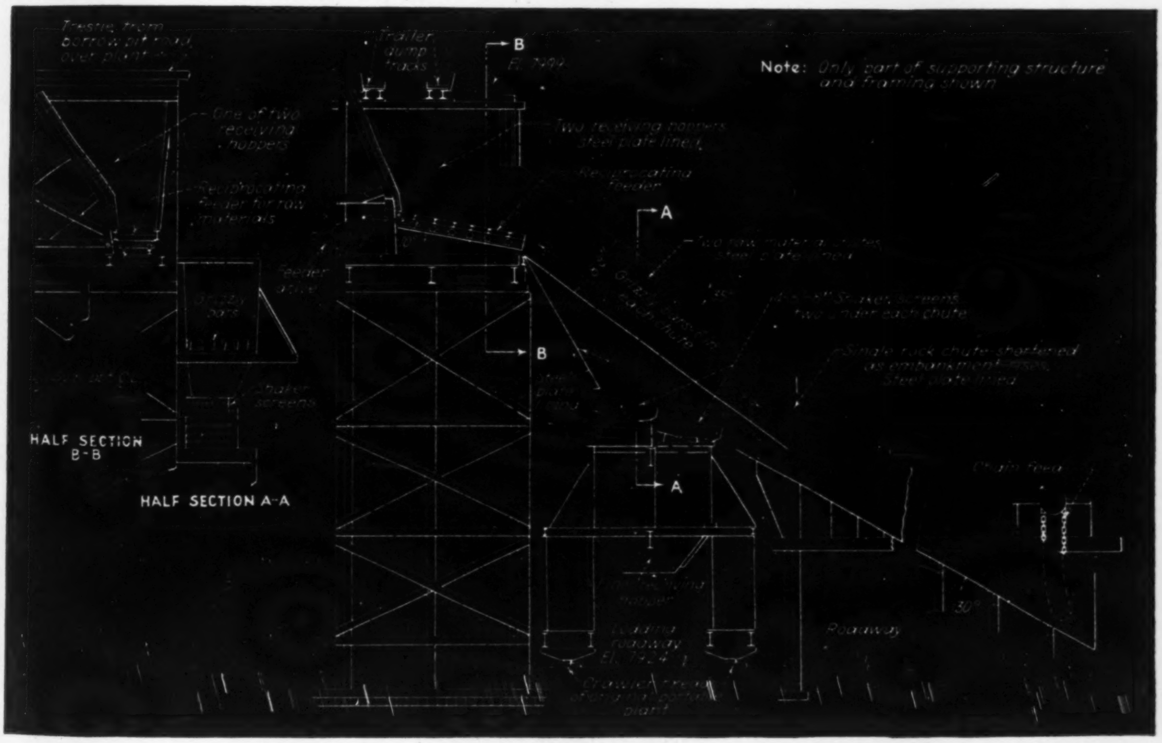

Trestle from borrow pit road over plant
Trailer dump trucks
B
El. 7999
Note: Only part of supporting structure and framing shown
One of two receiving hoppers
Two receiving hoppers steel plate lined
Reciprocating feeder for raw materials
Reciprocating feeder
A
10°
Feeder drive
Grizzly bars
Two raw material chutes, steel plate lined
35°
Grizzly bars, six in each chute
Shaker screens, two under each chute
B
Shaker screens
Single rock chute shortened as embankment rises. Steel plate lined
HALF SECTION B-B
HALF SECTION A-A
A
Chain feed
Fine receiving hopper
30°
Loading roadway El. 7924
Roadway
Crawler treads of original portable plant

Fig. 3. Diagrammatic sketch of the processing plant. The rock chute is shortened as the dam fill rises, requiring new ramps for the rock trucks. The screening plant for the fine impervious material remains in place for the life of the job.

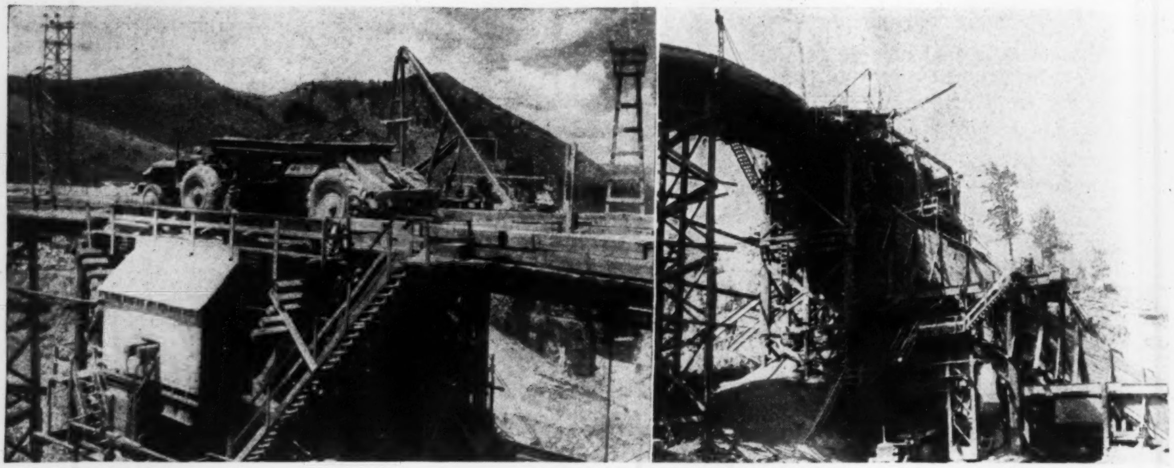


Fig. 4. Tractor-trailers discharge pit-run material (left) from the borrowpits into the top of plant from a trestle; view at right shows the screening plant for the fines going into impervious sections of the dam.

Cobbles and boulders too large to pass through the grizzly bars roll into this chute.

Material passing the bars drops down onto a set of two 5x8-ft. vibrating screens under each rack of bars. These screens pass all material under 3 in. into a hopper, rejects being kicked into the single larger chute with the larger rock and continuing down the canyon slope. The receiving hopper for the fines is fitted with two motor-powered slide gates for discharging into bottom-dump tractor-trailers. The roadway passing under the hoppers is at El. 7,924. A looping road on fairly easy grades leads to the upstream and center parts of the dam, where the fines, making up the impervious fill, are deposited.

The large single cobble and rock chute ends in an ingenious chain feed that is the key of the whole plant. This feed, an English patent, consists of a motor-operated shaft set above the chute, around which endless slack chains with links of 3-in. stock rotate. The chain loops rest on the chute floor with plenty of slack, and it is the weight of the heavy chains that retains the rock in the chute. As the chains are slowly rotated, the side of the loops next to the rock feeding downward, the rock dribbles out of the end of the chute, under the chain loops, into waiting end-dump trucks under perfect control. Stopping of rotation stops the flow of material. The secret of operation of the chain feed is to keep the chute well filled, otherwise a heavy rock rolling down an empty or near-empty chute may crash through the chains.

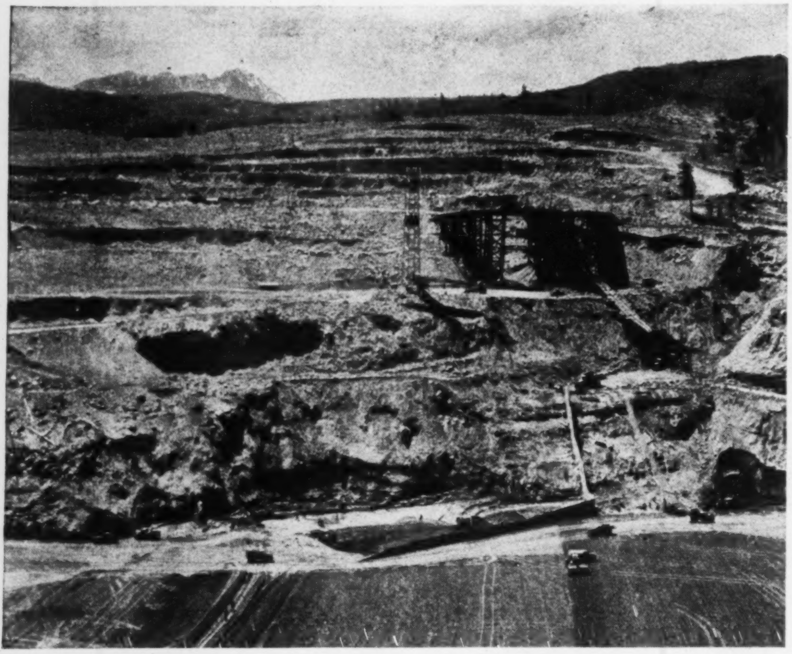


Fig. 5. Relation of the processing plant to the borrowpits, shown in background, and the dam, in the foreground, can be seen from this view taken from top of tunnel control tower.

As the embankment rises, the rock chute is shortened, thereby raising the elevation of the outlet. Good haul roads are maintained down the side of the canyon for the rock trucks, which dump their loads in the downstream section of the dam.

Details of the processing plant are shown in accompanying illustrations. This summer it is handling from 11,000 to 14,000 cu. yd. of material per day.

Tight embankment

The trailer-dumps deposit the impervious material in windrows to be spread with bulldozers. Treatment of the fill is routine, except that rolling is by special Bureau of Reclamation sheepsfoot rollers, having long conical teeth that exert a pressure of 470 psi. at the feet. Natural water content of the material is usually near optimum, requiring but little sprinkling. Tests show the impervious fill to be unusually well compacted, with wet samples running as high as 156 lb. per cu. ft. and averaging 150 lb. per cu.ft. Moisture content averages slightly less than 9 percent.

Special attention is paid to the

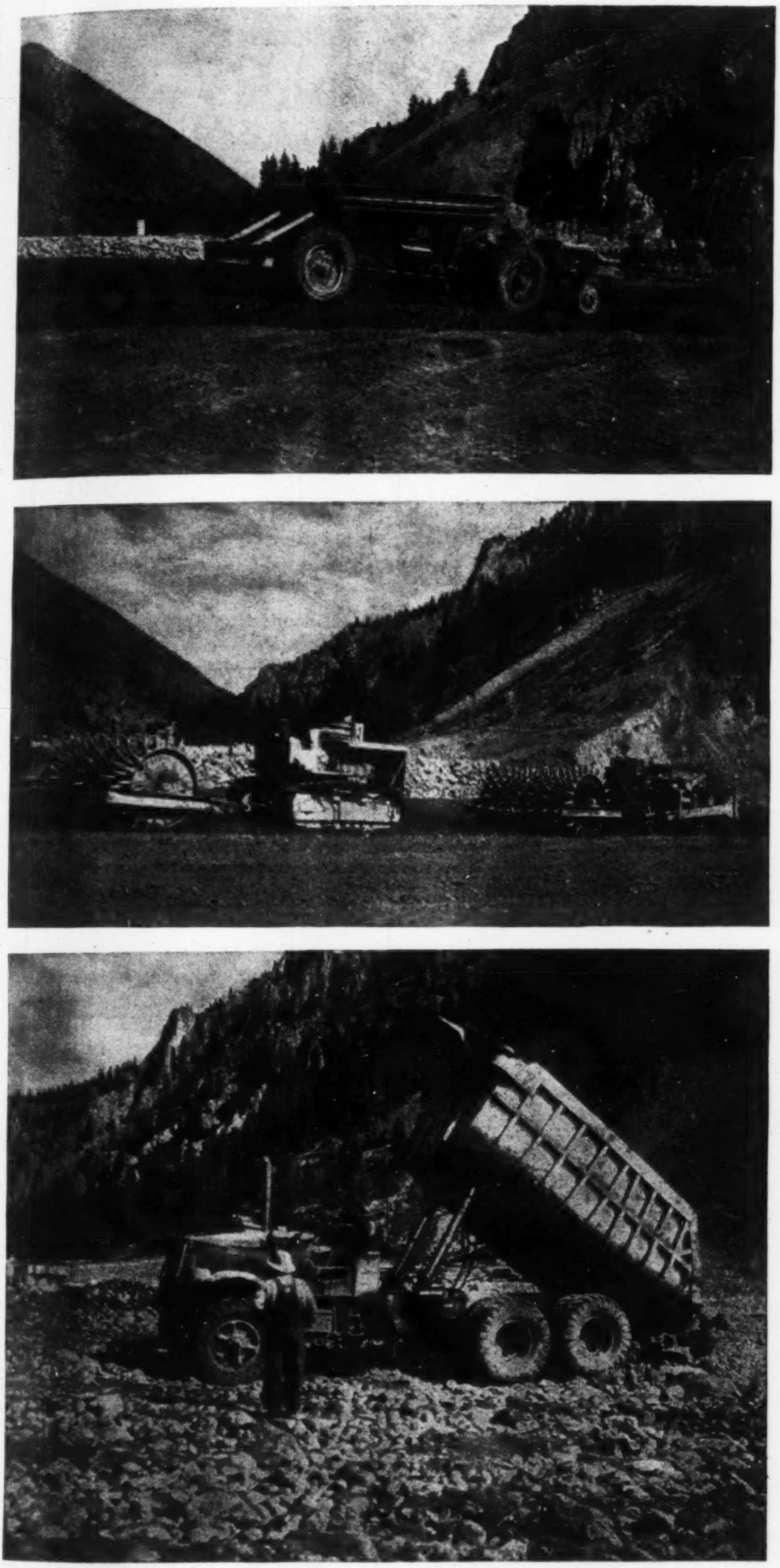


Fig. 6. Handling materials at the fill. Top view shows tractor-trailer dumping a load in impervious section; center view is that of special-tooth rollers tamping the fill; rock for the downstream section is handled in 24-yd. trucks, which maintain an even dump. The rolled fill section involves about 2,890,000 cu. yd. and the rock and cobbles will total about 1,360,000 cu. yd. exclusive of riprap. This material is obtained from a glacial deposit.

contact between fill and abutments. The contact rock face is cleaned and the fill material thoroughly tamped against it. At the right bank a shale formation is cleaned of disintegrated material and sprayed with a bitumen before the fill is deposited against it to eliminate sloughing.

Rock for the downstream section is dumped from the end-dump trucks in 3-ft. layers. Careful spotting of the trucks and spreading with a bulldozer compacts the rockfill level and keeps it smooth enough for truck travel over the fill.

Other features

Four concrete cutoff walls extending across the foundation and well up the sides of the canyon are completed. The powerhouse and spillway are well along. In both the latter structures absorptive form lining is being used for the exposed faces of the concrete.

The spillway channel, located on the left abutment, is being lined with 9-in. counterforted walls. Because of care required to protect the absorptive lining on the exposed face and the heavy reinforcing in the narrow walls, the contractor is adding a pouring pocket or chute at the rear of the walls midway between counterforts on the spillway walls.

The penstock tunnel is being used for diversion of the river (*ENR*, Dec. 5, 1940, p. 758). Installation of penstocks and the tunnel plug must await the end of river diversion. The trashrack structure, connecting to a shallow shaft downstream from a future tunnel plug, has been completed. Control gates will be at the bottom of a 260-ft. shaft sunk at the time the tunnel was driven.

The embankment is now about 75 percent complete, and probably will be finished late in the 1942 construction season.

Direction

The dam is being built by the U. S. Bureau of Reclamation under the supervision of John C. Page, commissioner and S. O. Harper, chief engineer. C. H. Howell is acting supervising engineer of the Colorado-Big Thompson project. Richard B. Ward is acting construction engineer in direct charge. The Warner Construction Co., Chicago, is contractor, for whom J. D. Fogg is superintendent, and R. T. Luedeking is engineer on the project.

Water Supply in Air Raids

Contents in Brief—*British experience reveals that water department activities following aerial bombardment fall in three classes: control of flow, maintenance of supply, and finally repairs. Specific suggestions in making this routine effective are outlined. Special emphasis is laid on interchangeability of equipment and the provisions for supplementary water supplies used in fire-fighting.*

A CONCISE REVIEW of some experiences abroad in maintaining water supplies during air raids appears in a recent issue of the *Glenfield Gazette*, published by Glenfield & Kennedy, Ltd., Kilmarnoch, Scotland. Extracts from this report, which follow, may provide helpful information to these in this country who are entrusted with the maintenance of water service.

Should dislocation or destruction of pumping stations, filtration plant or storage tanks take place, emergency plant, installed as standby, is brought into use. Pumping plant in particular, duplicating normal station equipment, but installed at remote sites, in invaluable. Arrangements for bypassing main reservoirs and filter beds in the event of derangement of these installations, combined with provision for sterilization of the water by means of chlorine, are essential.

Temporary breakdown of electric supply is not unknown during air attack, and although reestablishment of supply is invariably achieved in incredibly short spaces of time, the availability of prime movers other than electric motors is of great importance. The regular fire engine and the trailer pump are, of course, well to the fore in many emergency pumping and relay operations, but diesel engine units are also used, and air lift pumps, supplied with air by ordinary road compressors, serve to raise water from wells. Effective deployment of personnel and transport with adequate telephone facilities are essential.

Interconnection of mains, including the formation of ring mains, is of great importance in making available alternative routes for the water. Extensive interconnection is combined with the installation of such additional sluice valves as are necessary for the isolation of various sections in case of rupture.

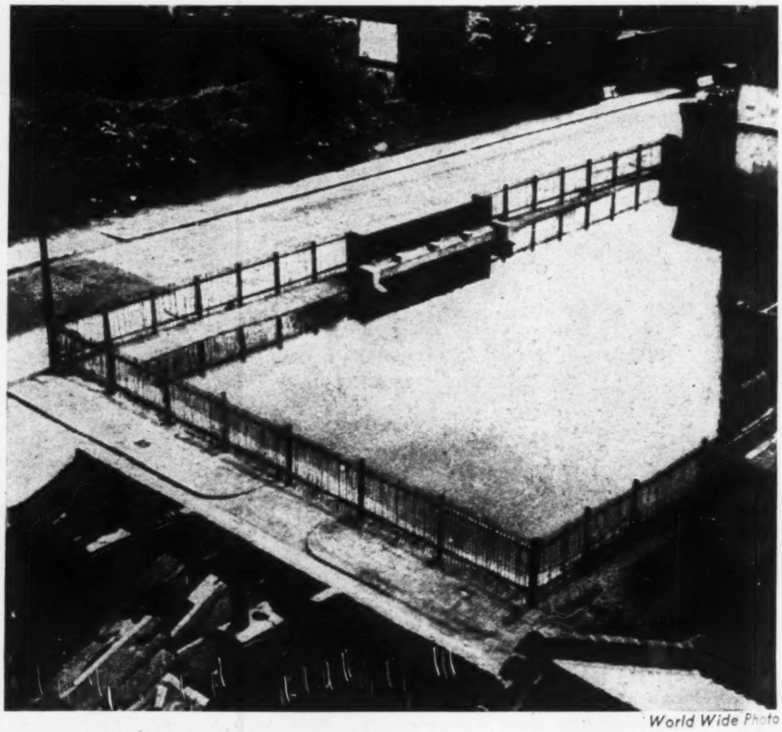
All valves are maintained in working order, and none is left in a doubtful condition as is often the case in normal times. The positions of all valves are clearly indicated on the surface. Several of the leading water authorities have purchased power-driven valve operating machines by means of which large sluice valves can be closed as rapidly as hydraulic conditions permit.

Emergency repair fittings for water mains are carried by most authorities. These fittings, which include stoppers for broken ends, enable the mains to be kept charged right up to the points of damage. They also enable craters to be bridged and local water supplies to be drawn off as required. The installation of additional branch pipes, fire hydrants and standpipes in strategic positions is of great utility.

Experience has shown that considerable stocks of pipes and fittings should be held at different points in the system and that long lengths of steel pipe in particular are most effective for the rapid reestablishment of broken mains.

Supplementary water supplies

Apart from the supplementary water supplies for fire fighting which, in some districts, can be taken from the sea, from rivers, canals, ponds, swimming pools and similar sources, areas of high risk are provided with water reservoirs consisting of pressed steel tanks or canvas dams at ground



World Wide Photo

Basement of a bombed building in London that now serves as a temporary reservoir to store water for fire-fighting.

level. Another plan adopted in some localities is to use the basements of buildings which have become untenable. Concreting of suitable basements is limited to that necessary to insure structural stability, and watertightness can be obtained by the application of mastic asphalt to the interior surfaces.

Many of the supplementary water supplies used for fire fighting are naturally quite unsuitable for domestic purposes. Where the water distribution system has temporarily failed, or the water is suspected of contamination and has not yet been rendered sterile, effective use is made of mobile water carts carrying one or more 250-gal. tanks. Fixed street tanks of the order of 500-gal. capacity are also used, and are kept full by patrols. In all cases where doubt exists as to the safety of the water, sterilization by chlorine solution is adopted, and as an additional safeguard, consumers are exhorted to boil the water before use.

Operations in the raid area

Work in an area that has been subject to bombardment is in three stages: (1) control; (2) maintenance of supply; and (3) repairs.

After a heavy raid a large number of mains may be broken and volumes of water running to waste. The first step is to check this waste. Valves are closed as necessary and broken ends of mains stopped. In some cases valves can be reopened after this has been done. One of the greatest difficulties is to get at a damaged main in a broken building or to a valve buried under débris. Where the task is too formidable for rapid action the section has to be isolated until the main can be stopped off. In some cases escaping water can be trapped in improvised sumps and used directly for fire fighting.

Automatic sprinkler installations cannot be relied upon: the supply pipes may be broken and storage tanks as well as mains may be running to waste. Nevertheless, there have been many instances of sprinkler installations extinguishing incendiary fires in cases where supply pipes have remained intact.

Maintenance of supply involves the effective utilization of whatever standby and emergency equipment can be usefully employed, as soon as the major waste from the system has been reduced. It may be necessary then to adjust valves at various points in the distribution network to insure that the best use is made of all available pressure supplies for fire fighting. The needs of fire services are, of course, placed before all other considerations. Auxiliary water supplies are brought into use at once and, where the water authority can take steps for the replenishment of these supplies, such steps should be taken immediately. Water for domestic purposes has then to be considered and where breakdown has temporarily occurred various expedients, such as standpipes and mobile water tanks, are adopted. All water of doubtful quality is dosed with chlorine before distribution.

Repairs are carried out as soon as possible, but it appears inadvisable to attempt to carry out much repair work during the hours of darkness. If the incidents are located so that repair gangs can be on the spot at daybreak, this will be the most that can be expected. Indeed it appears unnecessary to have many repair gangs standing by during the night.

It is generally understood that any new pipes that have been laid should be sterilized by chlorine and that mains should be well flushed out and the water treated with chlorine whenever disturbance has taken place. Particular care is necessary when sewers have been damaged and there is any possibility of contamination of the water system by sewage.

Questions of interchangeability of equipment, the importance of which have been greatly accentuated since nationalization of the country's fire fighting services, are of particular moment in relation to fire hydrants, standpipes for fire hydrants, fire hose couplings and adaptors for hydrant standpipes and couplings.

Dropping Concrete 50 ft. Without Segregation

CONCRETE was dropped through a 50-ft. free fall (maximum) into 10x10-ft. cofferdam cells sunk for placement of foundations in the Lois River Dam in British Columbia. There was some question at first whether this could be done with entire safety to the concrete, but it was found that so long as there was a free fall, with nothing preventing the concrete from landing in a single lump, no damage was done. If reinforcing had been involved or if there had been obstructions within the cells, results might have been different. The appearance of concrete placed in this way did not differ from that lowered the full depth in buckets nor was there any difference in the strength of test cylinders, which all surpassed the minimum requirement of 3,500 lb. in 28 days.

Looking down on the cofferdam into whose cells concrete was dropped from a height of 50 ft.

The concrete, which was delivered in 2-cu. yd. buckets, used 1 bbl. of cement per cu. yd. of aggregate with a maximum size of 4 in., mixed to give a 1-in. slump. By dumping the buckets at the top of the cells, instead of lowering them to the bottom, considerable time was saved and the expense of using elephant trunks was avoided. All the concrete was vibrated after placement.

The work was done for the Powell River Co., Ltd., by Stuart Cameron Co., Ltd., Vancouver, B. C.

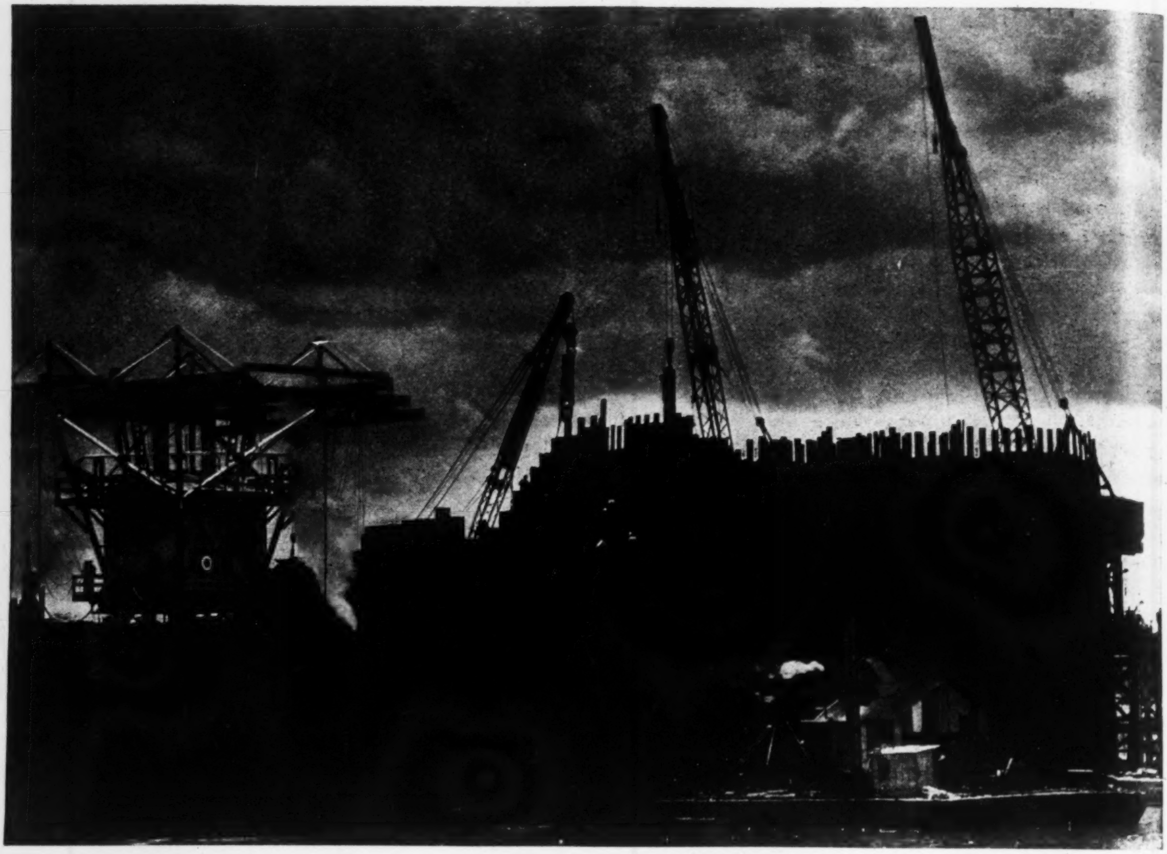


Fig. 1. Four-hammer traveler leads the array of piledriving equipment.

Big Rigs Drive Cofferdam Piles

J. W. Peerson

Office Engineer, Kentucky Dam, Tennessee Valley Authority

***Contents in Brief**—Driving of 19,500 tons of steel sheetpiling, 80 to 100 ft. long, for the first stage of the cellular cofferdam at TVA's big Kentucky Dam was done by a pair of four-hammer rigs, two gantries and two crawler cranes traveling on a trestle. Floating drivers and cranes aided the land equipment. Steel pipe templates spotted the sheets for forming the cells.*

PILEDRIVING EQUIPMENT in keeping with the size of the project was developed by TVA to build the huge cellular cofferdam at Kentucky Dam—largest of all its structures—on the Tennessee River 22 miles above its mouth. Two strings of drivers, each consisting of a four-hammer traveling rig, a gantry crane and a crawler crane working from a removable-deck trestle, augmented by floating derricks, drove 19,500 tons of steel sheetpiling required for the first stage cofferdam. The piling, 80 to 100 ft. long, was driven through a sand and gravel river bed overburden from 20 to 60 ft. deep. Pipe frame templates aided the driving.

The design of the cofferdam, to be built in two stages, was described in a previous article (*ENR*, Jan. 1, 1942, p. 30). Briefly, the first stage consists of a dike around the lock section at the right bank, earth dike arms extending from the lock dike to about low-water shoreline (El. 302) and 2,900 ft. of steel sheetpiling cells, including 35 circular cells 58.89 ft. in diameter and eight cloverleaf cells 90 x 100 ft., with two diaphragm walls dividing them into four sections. The circular cells are in the upstream and downstream shore arms; the cloverleafs are in the river arm. All piling is 15 in. wide, $\frac{3}{8}$-in. straight web, 38.8 lb. per lin. ft. Top of cofferdam is El. 336 (331 for the sections in the dry side of cloverleaf cells); river bed varies from El. 275 to El. 300; rock, upon which all cells are bedded, varies from El. 236 to El. 258. The first stage coffer incloses 40 acres. After 950 ft. of the dam has been completed in the first cofferdam, through which the river will be diverted in sluiceways, the second stage cofferdam about 2,500 ft. long, will be built of the same general design as the cellular wall part of the first stage. The first stage cofferdam was completed last winter after a year's work.

Planning for construction

While the very pervious river bed material made a positive cutoff to bedrock essential, some doubt was at first expressed as to the feasibility of driving steel sheetpiling to the great depths required. Tests conducted in conjunction with foundation explorations at the dam site demonstrated that ⅜-in. web piling could be driven successfully to the required depth at reasonable cost. However, it was apparent that piledriving would be the bottleneck of construction operations, and that a heavy concentration of hammers would be required to complete the structure in a reasonable length of time. This phase of the work greatly influenced the plan for constructing the cofferdam, and led to the adoption of land equipment traveling on a high timber trestle, supplemented by floating equipment. This plan had the advantage of utilizing both land and floating equipment, and also held promise of an efficient and easily coordinated method of attack.

Modified production-line methods were employed in construction of the cells proper. Three pieces of equipment traveling along the high timber trestle worked in tandem to perform the principal construction operations from initial stringing of the steel, to final topping out of short piles to bring the cells up to required grade. Each piece of equipment performed certain operations on each cell, then moved ahead with its track and repeated the process, completing the cells in stages. Two strings of equipment were provided to permit simultaneous construction at two points.

Construction trestle

The trestle was built ahead of cell construction. It consisted of 6-pile timber bents capped at El. 333, surmounted by portable unit deck sections so designed that they could be moved ahead as the cells were driven. Base-of-rail on the trestle deck was at El. 336, or 34 ft. above normal water surface. Three piles were centered 8 ft. to either side of the center line of the bent. The center pile in each group of three was driven vertical and the two outside piles were driven on a batter of 1:12. A conventional two-story timber bracing system consisted of two 3x10-in. horizontal members just above the water surface and another set 14 ft. below base of cap. A 12x12-in. timber cap 24 ft. long, drifted to each pile, served as the top brace and completed the horizontal bracing system. Cross bracing between horizontals consisted of one 3x10-in. member each side of piles.

Timber bents for the circular cells were spaced 17.625 ft. apart, determined by the necessity for providing a rigid three-bent tower structure at intervals along the trestle. Thus, with cells spaced 70 ft. 5 in. c. to c. this resulted in placing three bents in each cell and one bent on the center line between cells. The three bents within the cell were tied together by 6x10-in. horizontal braces and 3x10-in. cross-bracing. The single bent between cells was fastened to the tower structure in front by 6x10-in. horizontal timber struts only, no cross-bracing being provided in this bay. No struts were connected to the tower structure behind.

Construction of the cloverleaf cells required a double trestle spaced 41.16 ft. c. to c., or 20.58 ft. each side of longitudinal center line. This placed the center line of each trestle on the center of radii of the arcs forming the cloverleaf cells, and in this position the trestle equipment could maintain the same relative position with respect to the piling in the arcs as was the case in the circular cells. The piles forming the diaphragms were, of course, closer in to the trestle. With cloverleaf cells spaced 93.5 ft. c. to c., five equal bent spaces of 17.625 ft. and one odd space of 5.375 ft. at centerline of the cell resulted. This arrangement permitted the forming of a three-bent tower structure in the quadrant of each cloverleaf and eliminated the necessity of placing temporary struts across lines of sheetpiling. However, 6x10-in. struts at the top of the two bents to either side of center line of cell tied the towers together for added rigidity.

On curves the bents were spaced to suit each particular location. The same type bent and same bracing pattern was used throughout.

Douglas fir piles with a minimum tip diameter of 9 in. were driven to a minimum penetration of 20 ft., and to a bearing value of 50,000 lb. as computed from the *Engineering News* formula. Where all piles drove below grade before the required bearing was obtained, the piles were cut off at the level of center horizontal bracing system, capped off, and a pony bent added to bring the bent to required grades. In some cases additional piles were necessary for the total required bearing.

Standard portable deck sections were made up of two 17.6-ft. lengths of 100-lb. rail, spaced 16 ft. apart, eight 12x12-in. ties 20 ft. long and four 24x9-in. 87-lb. I-beam stringers 18.875 ft. long, two under each rail. All beams, parallel to each other, were

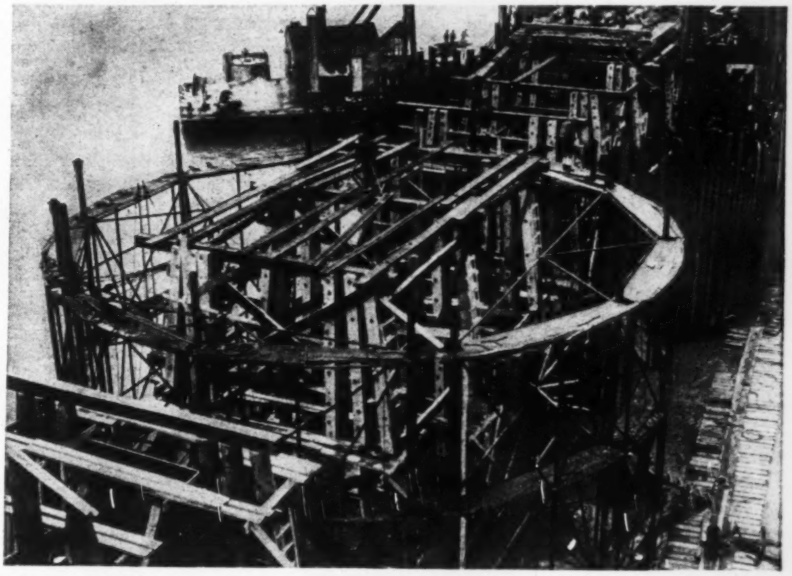


Fig. 2. Steel-pipe template for forming the circular cells of the two shore arms. Cut into four segments, the same templates formed the cloverleaf river arm cells.

out of parallel with the rails by 10 in., which permitted interlapping of beams for full bearing over the cap. Short channels were welded to the bottom of each beam as a shoe to fit over the cap and hold the deck section in place, bearing on a plate spiked to the cap. No connection between beams and cap was provided.

The bracing and strut system of the deck sections served as the only lateral bracing for the trestle. Diagonal 1-in. oak boards spiked to the ties provided a working platform and added further rigidity to the deck. Deck sections were handled by a four-way cable sling fastened to lugs. Rails between deck sections were connected by standard splice plates and bolts, and the joint further supported by blocking underneath.

Building the trestle, containing 85,000 lin. ft. of timber piles, was a big job in itself. Considerable study of driving methods resulted in the design of a special timber template, 22 ft. in height, consisting of a system of vertical and batter timbers placed in pairs to form a separate slot in the correct position and batter for each pile. This template was mounted on one side of a 20x70-ft. steel barge, overhanging the edge. Platforms at two levels above the deck were used by workmen in setting and driving the piles and for cutting off and capping the bent. Short sections of steel sheetpiling served to counterweight and trim the barge so that a plumb bent would result. A system of spars, hand winches and capstans on the barge deck provided means for spotting and holding the barge and template in proper position for piledriving. For driving the double trestle in the cloverleaf cells, a second template was added permitting all piles for both trestle bents to be driven from one set-up.

A floating derrick placed the piles in the template and drove them to grade. A 7,000-lb. double-acting steamhammer, equipped with bell-bottom anvil block and a basket arrangement designed to fit over top of pile and hold the hammer in proper alignment, was used for driving.

Cofferdam templates

Three movable circular templates, 26 ft. high, of all-welded $2\frac{1}{2}$ and 3-in. pipe, supported the circular cell piling during stringing and for initial driving operations. Each template was divided into four sections designed to fit around the timber trestle, and strutted and tied to it for added rigidity. Each of the four sections was supported by 6-in. pipe spuds 55 ft. long. Pins through $1\frac{1}{4}$-in. holes, 6 in. apart in the spuds, provided means for supporting the template at any desired elevation. In shifting the template the spuds were picked up by moving the pins from bottom to top of spud plates.

Ten-ton push-pull jack spreaders with adjustable pipe extensions welded to the running nut at each end, fastened template sections to the trestle. The spreaders were pin-connected to the upper and lower corners at each end of each template section, and when not in use or when the template was being moved, were suspended from that point. A simple connection at the opposite end of the spreaders fastened to the trestle piling. While the spreaders could be used either to push or pull the sections in position when setting, once the template was connected up all spreaders could be converted to compression members by running out the jacks a turn or two.

Although the circular templates were designed originally for use in the large-diameter circular cells, the same sections also were used in the cloverleaf cells. In this location they were used in combination with built-in-place timber templates supported from the construction trestle. Templates for the connecting cell for both circular and cloverleaf cells were laminated timber arcs supported by knee braces from the trestle bents.

Driving rigs

Each string of equipment operating on the trestle included a gantry crane,

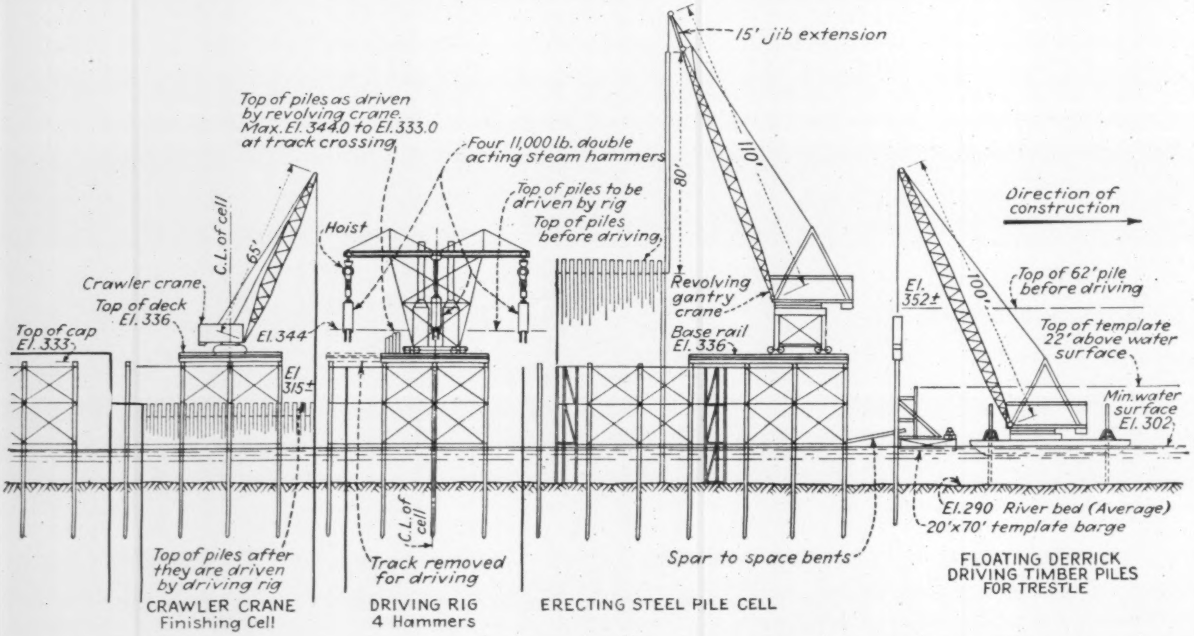

15' jib extension
Top of piles as driven by revolving crane. Max. El. 344.0 to El. 333.0 at track crossing
Four 11,000 lb. double acting steam hammers
80'
110'
Top of piles to be driven by rig
Top of piles before driving
Hoist
C.L. of cell
65'
Crawler crane
Top of deck El. 336
Top of cap El. 333
El. 344
El 315±
Revolving gantry crane
Base rail El. 336
Direction of construction
El. 352±
100'
Top of 62' pile before driving
Top of template 22' above water surface
Min. water surface El. 302
El. 290 River bed (Average)
20'x70' template barge
C.L. of cell
Top of piles after they are driven by driving rig
Track removed for driving
Spar to space bents
CRAWLER CRANE Finishing Cell
DRIVING RIG 4 Hammers
ERECTING STEEL PILE CELL
FLOATING DERRICK DRIVING TIMBER PILES FOR TRESTLE

Fig. 3. Cofferdam piledriving procedure and equipment are illustrated in this diagram of successive operations.

a four-hammer traveling rig and a crawler crane, working in that order (see illustration). The gantries were full-revolving electric cranes running on the 16-ft.-gage track of the trestle on swivel-type motor-driven trucks. Their normal 95-ft. booms were equipped with 15-ft. jib extensions for stringing the 80-ft. piles. The two crawler cranes, diesel drive, had 65-ft. booms with a lifting capacity ranging from 2 tons at 65-ft. radius to 10 tons at 20-ft. radius. While too light for heavy driving operations, these cranes were ideal for driving single piles and for stringing the top course to complete the cells, and thus worked in the No. 3 position in the string.

The two four-hammer rigs were designed and built by TVA forces. Each rig, a self-contained unit equipped with four 11,000-lb. double-acting steam hammers, consisted of a 17-ft. square car body mounted on four two-wheel swivel-type trucks spaced 16 ft. apart both ways. The car body supported two 125-hp., oil-fired, vertical boilers that also supplied steam to the crawler crane hammers, oil storage tanks, water tanks, transformer equipment, and a mushroom-shaped steel tower that supported the pile driving equipment.

This tower, 32 ft. high above car body, was 16 ft. square at the base and 32 ft. square at the top. Main top members were two pairs of 18-in. I-beams, 65 ft. long, spaced 32 ft. apart and at right angles to each other. These formed the main top member for each tower side, and the overhang of 16.5 ft. at each end formed parallel runways from which the overhead trolleys could be suspended.

Trolley construction

The overhead trolleys consisted of two sets of geared travelers attached to a 20-in. I-beam, 52 ft. long. The trolleys were spaced 32 ft. on centers, and were symmetrical with respect to center of beam. The 20-in. I-beam, in turn, served as a runway to carry an 8-ton electric trolley hoist from which the hammer was suspended. A compression-type coil spring shock absorber formed the connecting link between hammer and hoist.

Travel of the overhead trolleys was limited to 13 ft., the inner limit of travel being 18 ft. from center line of car body and the outer limit 31 ft. Trolley hoist travel in a direction at right angles to overhead trolley travel was limited to 44 ft. or 22 ft. either side of center line of car body. The two-way motion thus provided enabled the four hammers to cover a 62-ft.-dia. circle except for a 36-ft. square in the center. Overlapping of coverage at quarterpoints allowed some flexibility in operation if it became necessary for any one of the hammers to drive more than its allotted number of piles.

Originally, operation of overhead trolley and trolley hoist was by hand chains from the trestle deck, and hoist control was by pendant ropes from the same level. Although this arrangement proved satisfactory, after operating the first rig for a short period, substantial economies were believed possible if all hand-operated equipment were converted to motor drives and pushbutton control. This change was later made on one rig, but work had by this time reached such an advanced stage that the second rig was never completely motorized.

Platforms for convenience

Two platforms around the outside of the rig were provided for the convenience and safety of the operators, one at the car level and the other 16 ft. above. The upper platform served as working space for two throttle operators (one for each of the two hammers).

Steam lines were run up from a header between boilers and out in pairs to the two opposite corners of the rig. Here quick-opening valves permitted one operator to control two hammers with an unobstructed view of their work. The steam lines from here were run down under the platform and off in opposite directions to center line of tower, from which point connection to the hammer was made by a length of 2½-in. metal-clad steam hose. All other operations were carried on from the lower platform or from the trestle deck.

In designing the rig, every effort was made to secure maximum operating efficiency. All controls, as far as possible, were grouped for operation from a central point so located as to give the operator an unobstructed view of the equipment. Service lines leading to the rig (oil, water and power) and steam lines leading out were brought in over the top and down the tower to keep them clear of the operating equipment and to obviate the necessity of bringing them in over the sheetpiling being driven. Connections to the source of supply were made by means of flexible hose or cable.

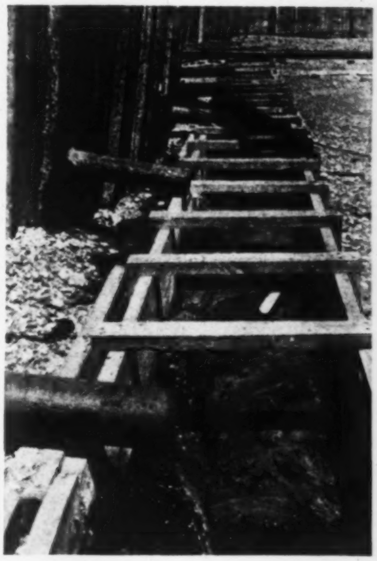


Fig. 4. The cell drainage system is elaborate. Here is part of the cloverleaf cell drainage at work.

Driving of the timber piling trestle, carried on two to four cells in advance of cell erection, was the first construction step, carried out by a floating crane and the special template barge. Next came the carpenter crews who placed the timber bracing members, completing the trestle structure except for the deck. This work usually followed timber piledriving operations by about one cell and preceded erection by one to two cells. The next operation was placing the steel pipe template for the cell next in line for erection. Three templates were available, so although two were always in use, the third was ready for setting in the next cell ahead. Usually the templates were set by a floating derrick, though occasionally the leading trestle crane was utilized.

Cofferdam construction

After the template was placed, the gantry crane moved the track section binding the back side of the cell to the front end of its line of track. This left the whole cell perimeter uncovered, except for the track sections in use by the crane which, of course, interfered with closure of the front side of the cell. Stringing alternate 75-ft. and 80-ft. piling on the back side was then commenced by the gantry and the segment between wyes and a few piles to either side were strung. The connecting arcs between the partially completed cell and the partially-driven cell behind, were strung next and then both sides were strung alternately as the crane backed away, and finally after backing away and moving track as required, closure was made on the front side. As stringing progressed, the piles were braced with inside guy cables. Follower piles, 6 ft. long, were next strung to fill the 5-ft. gap between 80-ft. piles, and the cell was ready to be driven. At this stage the top of piles were usually uneven, conforming to river bed contours.

Driving was then started by the gantry crane, first tapping down the high spots until the tops of piles were approximately level. Driving then continued by driving the piles in pairs around the cell, including the connecting arcs, in stages of 2 ft., down to El. 344.

At this stage a gap was driven on the shoreward side about 24 ft. wide to El. 333 to permit entry of the four-hammer driving rig, the piling to either side being stepped up in pairs at the rate of 2 ft. per pair until El. 344 was reached. Driving by the gantry crane was then discontinued and the template removed by either this crane or a floating rig.

Driving of the cell from El. 344 down was by the traveling rigs. These entered the cell through the gap driven to El. 333, and continued driving the piles in pairs until seated on rock. Since one pile in each pair was 80 ft. long, and the mate made up from a 75-ft. pile and a 6-ft. follower, was 81 ft. long, the latter always reached rock first. The crawler crane followed the driving rig, removed the 6-ft. followers, and drove the alternate 80-ft. piles singly to rock. After this operation had been completed, the top course of piles to bring the cell up to required grade were strung in, completing the cell.

Filling the cells was done by a suction dredge which pumped sand and gravel from the river bed into the cofferdam. As the cells were stable when driven to grade, no attempt was made to fill them in the order completed. Filling was usually arranged to suit other dredging operations, and often completed cells were left unfilled for considerable periods of time.

Special care was taken in starting the first sheet of each cell to keep the piles plumb. Maximum permissible lead of adjacent pairs of piles was 2 ft., and tops of piles were kept as level as possible until driven to rock. Driving was immediately discontinued when rock was struck.

In cases where driving indicated a very uneven rock surface, or where piles exhibited peculiar driving tendencies, the exact rock elevation was determined by drilling. Where such investigation disclosed damaged piles, they were removed and replaced or given a heavy grout treatment.

As cell construction progressed, and after each cell was completed, the rock surface and bottom of piles were plotted. Where individual or small groups of piling had not reached bedrock, both the foundation rock to a depth of 10 ft. and the overburden in the vicinity of such piles were thoroughly grouted through holes drilled on 10-ft. centers. If conditions indicated need for additional treatment, intermediate holes were drilled and grouted.

Foundation treatment

Prior to start of construction a row of holes 60 ft. apart and inclined at 45 deg. was diamond-drilled along the centerline of cells. These holes, drilled from barges, were for the dual purpose of exploring and grouting the rock foundation and for defining the limits of a seam encountered by preliminary drilling. All holes were drilled at least 56.5 ft. (40 ft. vertically) into rock and were grouted with neat cement under a pressure of 15 to 20 psi.

After the cells were filled, a line of diamond-drill holes, 20 ft. c. to c., was put down through the cell fill 40 ft. into bedrock. These holes were also grouted with neat cement, in this case with a minimum pressure of 30 psi. A limit of 50 to 100 bags of cement per hole was established for these holes, as determined by the size of the cavity encountered. The cutoff across such cavities was effected by drilling and grouting additional intermediate holes as required, and in some cases by adding calcium chloride to the grout to accelerate the initial set and confine the grout more closely to the desired area. Unwatering of the cofferdam was delayed until this work had been completed.

Similar treatment was given the foundation under the earth dikes connecting the upstream and downstream arms of the cofferdam. Under the upstream dike a large weathered zone was encountered in the bedrock, and as a measure of economy a clay-

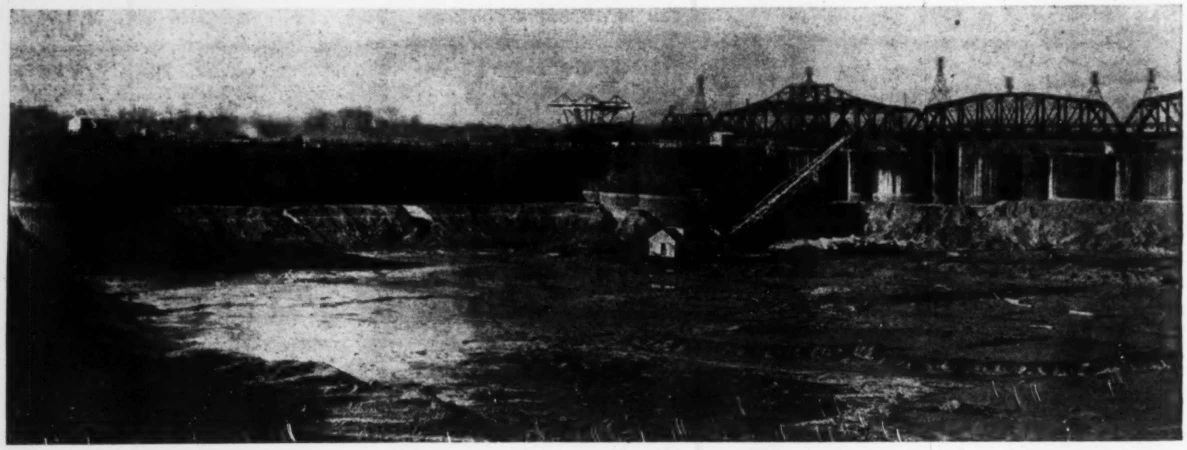


Fig. 5. Part view of the first stage cofferdam shortly after unwatering. Closure was postponed to permit removal of as much overburden as possible by suction dredge.

cement grout was used here. A 1:6:5 mix (cement-clay-water) was used and the grout was pumped into the holes to refusal. One hole in this area took 32,500 cu. ft. of grout, others from 200 to 8,000 cu. ft. The overburden for 40 ft. above rock in this area was also grouted by raising the casing in stages of 2 ft., grouting each stage to refusal.

After the cofferdam was unwatered, it was found that leakage was very slight, and several springs accounted for between 80 and 90 percent of the inflow. Drilling was immediately started in an effort to box these springs in and cut them off by grouting, a procedure not entirely successful. While this leakage is not considered serious, the inflow is enough to flood out equipment in the protected area should an interruption of power occur for even a few hours. This later led to a decision to install auxiliary gasoline-engine pumps of sufficient capacity to take care of the inflow.

Unwatering and maintenance pumping

Before closure of the cofferdam, a deep hole was excavated in the river bed near the upstream corner of the river arm as a temporary sump for unwatering operations. Four 14-in. vertical centrifugal pumps, each with a capacity of 2,000 gpm. at 80-ft. head and 6,500 gpm. at 30-ft. head, were hung from the top of a cofferdam cell. Discharge lines were run over the top of the cofferdam and down to 7 ft. below river surface to give a siphoning effect.

Air valves were installed at the top to break the vacuum when the pumps were shut down thus keeping the flow from reversing, and preventing the pipe from collapsing under the high vacuum. The pumps were suspended by 10-ton chain hoists and as the water was pumped down the pumps were lowered and additional pipe added as required until the cofferdam was unwatered.

Immediately after the coffer was unwatered, maintenance pumping equipment was installed, located at the downstream corner of the river arm. Boring records indicated the general slope of rock bedding planes to be toward that point and rock was the lowest here.

An 8x22-ft. sump, 5 ft. inside the sheetpiling was line-drilled and excavated to a depth of 10 ft. in rock. Gravel-filled cribs were erected on either side to retain the berm slopes, and a timber tower 120 ft. high provided support for four pumps similar to those used for unwatering the coffer. These pumps were also supported by 10-ton chain hoists and cable so they could be lifted to keep the motors above floods which might overtop the cofferdam.

These pumps discharge into a 12x23-ft. concrete sump, sunk 14 ft. into the river bed. This sump, with top at El. 292.5, was connected with the one below by a 14-in. overflow pipe. Four pumps were installed at the upper sump. Two bents of the trestle, with a 12-ft. timber tower built on top, form the supporting structure for the pumps in this case. The discharge lines pass through the cofferdam at El. 333.5, discharging into the river. The intermediate sump, pumping equipment, etc., located in this position, will remain in service for Stage 2 cofferdam.

Flooding and drainage facilities

As soon as the coffer was unwatered, construction of the cell drainage system and cofferdam berm was started. The drainage system was designed to drain seepage water from the cell fill, to lower the saturation line within the cells, and to collect the leakage and direct it to the main pump sump.

In the circular cells two horizontal rows of weep holes were burned in the piles on the inside face, one row at river bed, the other at top of berm. Nine holes were cut at each level for each circular and connecting cell. At the river bed 4-in. pipes welded in the holes connect to 15-in. corrugated pipe headers laid parallel to the cells which, in turn, lead to 24-in. collecting headers spaced 300 ft. apart around the inside of the cofferdam. These headers lead out under the berm at river bed level and discharge into open flumes laid down the slope of the berm. At top of berm the 4-in. pipes welded into the weep holes discharge into an open flume laid along top of berm. These flumes connect to the 24-in. headers of the lower drainage system by 15-in. risers. The lower drainage system was installed first, the berm was then placed, and when completed to final grade the upper drainage system was installed.

The drainage system for cloverleaf cells is similar, except that there is only one row of holes. Twelve holes for each main cell and three for each connecting cell were provided at river bed level. The 4-in. pipe welded in each weep hole discharges into an open flume, which leads to the main pump sump.

A sluice gate at El. 302 and two concrete weirs at El. 320 closed by timber needle beams to top of cofferdam, for flooding the inclosure, were described in the previous design article. After the coffer was unwatered, a 72-in. steel pipe 66 ft. long was connected to the flood gate, and at the discharge end of the pipe an open diverging concrete flume 32 ft. in length, with baffle-end wall, was constructed to extend the point of discharge down the berm a safe distance from the cofferdam. A heavy concrete slab, 30 ft. wide at El. 300.5 with wing walls 3 ft. high and a heavy riprap extension down the slope of the berm, was also installed to protect the cofferdam berm at the weirs.

For observing the saturation line within the cells, a row of 4-in. perforated pipes, 23.5 ft. c. to c., in the circular cells and about 31 ft. c. to c. in the cloverleaf cells, were driven into the cell fill material along the line of the inside wye piles. In the circular cells the pipes were driven to El. 302 and in the cloverleaf cells to El. 287. These observation wells will provide a means of checking the efficiency of the drainage system during flood stages of the river and will give warning in case this system fails to function.

The Kentucky Dam is being built by the Tennessee Valley Authority under the general direction of T. B. Parker, chief engineer, and A. L. Pauls, chief construction engineer. In direct charge of the work at the site is G. P. Jessup, project manager and B. S. Philbrick, construction superintendent.

J. B. Hays served as construction engineer at Kentucky Dam until a recent transfer to new projects. He has been succeeded by H. L. Broadfoot, formerly assistant construction engineer.

Plans for constructing the cofferdam including design of timber trestle, portable deck sections, and cofferdam templates were prepared in the project office at the site. The cofferdam was designed by the design section, construction plant division, of TVA under the general direction of R. T. Colburn, division head, and L. A. Schmidt, Jr., then construction plant design engineer.

Two-Pipe Pile Jetting Rig Speeds Driving on Navy Pier Job

A New Pier being built at an important Navy yard requires some 2,000 concrete piles, which are being put down with a minimum of driving effort by using two jets, one on either side of the pile, and each combining high-pressure water and air. To permit the jets to work on any two of the four sides, the hammer is breasted out from the leads far enough to allow the jet pipes to function on the driver side of the pile. A steel yoke at the top keeps the upper end of the jet pipes, which are 4 in. in diameter, a uniform distance apart as the pair is worked up and down around the pile.

This arrangement keeps the pile plumb as it goes down and so increases the effectiveness of the placing operation that although the weight of the hammer rests on the pile during jetting, actual driving is not required until the pile is within a few feet of its final depth and then the driving brings each pile practically to refusal.

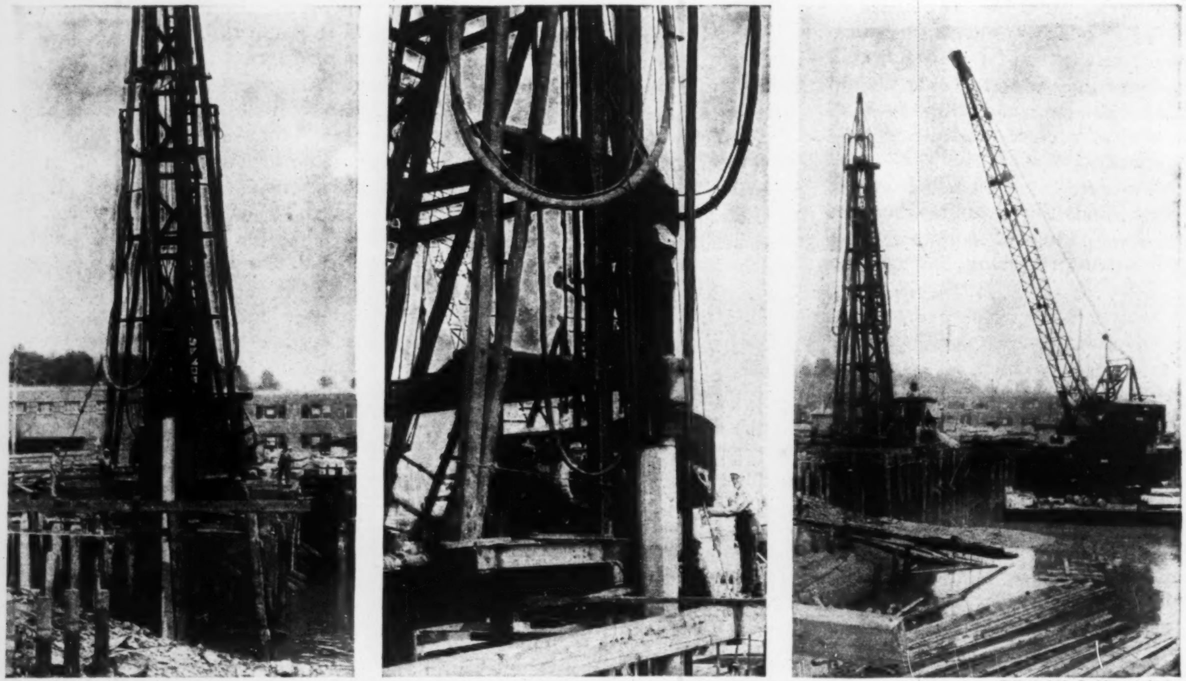
The pier for which these piles are being put down will carry live loads up to 1,000 lb. per square foot, and the design calls for piles on 3-ft. centers. For lengths up to 50 ft., piles 16 in. square are used; the longer piles are 18 in. square. Lengths range from 30 to 76 ft.

At the outset, before the special jetting rig was devised, a central pipe, cast in the pile for the purpose, was used for jetting. Under the foundation conditions here encountered, i.e.: a mixture of sand and gravel up to 4 in. in size with occasional boulders and other obstructions; this was not satisfactory because of the time required in driving, due principally to lack of jet penetration in the gravel as well as the inability to get around the boulders and obstructions. The rig was then equipped with the two jets as described, using the 4-in. jet pipes terminating in 1½-in. nozzles. Water for jetting is supplied by two motor-driven pumps rated at 500 gpm. each and delivering at a pressure of 350 psi. The supply line, 8 in. in diameter, delivers to a 6-in. hose for the necessarily flexible connections to the rig, and through 4-in. hose to the jet pipes. Along each jet pipe and welded to it at 5-ft. intervals is a ¾-in. air line through which compressed air is delivered parallel to the water jet. The water jets are made more effective by this addition of air, which gives to the waste water from the jet a definite movement, thus helping lift the loosened material.

The yoke at the top is a heavy steel bar carrying at either end the 4-in. inverted U to which the flexible hose deliver and from which the 4-in. jet pipes suspend. The yoke is connected to the jets through a single pin, which allows a certain articulation, necessary at times. With this arrangement, a single wire rope handles the jets.

The work is being done for the U. S. Navy by the Bureau of Yards and Docks under the direction of Rear Admiral Ben Moreell.

The contract is held by a combination of two firms, Rumsey & Co. and the Puget Sound Bridge & Dredging Co. Evald Anderson is superintendent for the contractors on the pier project.



Official U. S. Navy photos

A pair of 4-in. jet pipes, (left) fastened together at the top by a steel yoke, make it possible to put down 18-in. concrete piles on 3-ft. centers. The hammer is breasted out from the leads (center) to give the jets access to all sides of the pile. Piles are delivered to the driver (right) by a floating crane or a crawler crane on shore.

Contractors On Public Work Benefited By Legal Decisions

George R. Shields
King & King, Attorneys, Washington, D. C.

***Contents in Brief**—Two decisions of great importance to contractors on government work were rendered recently by the United States Court of Claims. Risks assumed by the contractor under the general provisions of his contract are more clearly defined. The court reaffirmed and clarified earlier decisions that distinguish between findings of fact by the contracting officer and construing the contract terms, stated that doubtful provisions of a contract drawn by a contracting officer must be interpreted in the contractor's favor rather than his own, and amplified earlier decisions on such matters as conflicts between general and specific provisions of contracts, delays, and changed conditions under a contract.*

THE UNITED STATES COURT OF CLAIMS has within recent months rendered two very important and far-reaching decisions (*W. E. Callahan Construction Co., et al.* v. *United States,* 91 C. Cls. 538; *Hirsch* v. *United States,* decided on Nov. 3, 1941, 94 C. Cls.), which clarify certain questions of contract law that were hitherto in an always shadowy status, and which decide others in a manner that should settle them for a long time. These decisions are of prime concern to every contractor having any considerable dealings with the United States. It will be the aim of this article to set out some of the more important phases of these decisions.

The Callahan case was a suit growing out of the contract for Madden Dam in the Canal Zone. It involved some thirty-odd separate and unrelated claims, most of them arising, however, from contested rulings and decisions of the contracting officer. The court's decision really amounts to a compendium of law as to the force and effect of such decisions. A few of the questions involved will be briefly summarized.

Flood Damages

The contract made the contractor responsible for "all risk of damage to his plant, equipment and operations at the gravel deposits, by reason of flood . . ." The gravel deposits were located some 6,000 ft. down the river from the dam where the contractor had set up a conveyor system to convey gravel to the screening plant, three towers of which were in or adjacent to the river. After this plant had been in efficient operation for some months, a high flood occurred in the Chagres River. Before this flood, the government, by separate contract or with its own force, had been clearing the basin above the dam and had left much debris and some very large logs, which were carried away by the flood and some of which lodged against the towers of the conveyor system, with the result that the towers collapsed, the cableway broke, and the plant was wrecked.

The contractor claimed and the court concluded that the damage done to the plant was not by high water as such but by the extra hazard added thereto by the government. It was held in effect that the very fact that the contractor assumed the risk of damage by high waters carried with it the corollary obligation by the government not to add to the natural hazards so assumed. Judgment was allowed for the cost of restoring the plant plus the extra cost of handling gravel by truck while the plant was out of operation.

Findings of fact

The court reaffirmed the rule that a provision making an officer's determination of disputed matters of fact is not authority for his conclusions of law, i. e., his construing the contract terms. The Court said:

> "At this point it should be stated that practically all the decisions and recommendations of the contracting officer and the head of the department in regard to practically all the claims in suit were based upon constructions which they placed upon certain articles of the contract and specifications, rather than upon their findings upon disputed questions of fact. Plaintiffs in practically every instance duly and timely protested and appealed with respect to the claims here involved, which arose from (1) directions and instructions of the engineers and inspectors immediately in charge of the work; (2) rulings and orders of the construction engineer and written changes made and ordered by the contracting officer. The protests and claims were made to the construction engineer, to the engineer of maintenance, who was the duly authorized representative of the contracting officer and who acted as the contracting officer in the matter of protest; and, to the Governor of Panama, Canal Zone, who in addition to being the official contracting officer, was the head of the department concerned. A few of the plaintiffs' protests were not made within 10 days, but the contracting officer did not reject any of them on that ground but considered and decided them on the merits. By so doing he waived the 10-day provision. *Thompson, et al.* v. *United States, ante,* p. 166. The contracting officer was expressly authorized to extend the time."

The court said further on this point:

> "The rule is well established by the decided cases that in contracts of this character where, as in Art. 15 above-mentioned relating to disputes, it is provided that the decision of the contracting officer and the head of the department shall be final and conclusive only as to questions of fact, a decision or ruling on a protest or appeal which involves or is based upon an interpretation and construction of a contract and the specifications is a decision on a question of law rather than a determination of a fact and does not preclude the consideration, decision, and determination by the courts of the question in controversy, including the facts. *Rust Engineering Co.* v. *United States,* 86 C. Cls. 461, 473."

Doubtful provisions

The court gave to the contracting officer a lecture that should be enlightening to others in similar position. It said:

> "Where an instrument, especially one of such character as is involved in this

> suit, is drafted and prepared entirely by one party thereto, and is specific in its detailed requirements, subsequent doubts as to the meaning and applicability of the language and provisions thereof to definite facts, conditions, situations, and circumstances should not be interpreted and construed in favor of the party who drafted and prepared it, but, on the contrary, in such cases the provisions of such instrument should, in case of doubt and in such circumstances, be interpreted more favorably to the other party who did not and could not, in the circumstances, have anything to say as to the language and provisions of the instrument as prepared. The reason for this rule is that since the contract, the detailed drawings and the specifications were not the result of negotiations between the parties before execution it is only reasonable to presume that the party who prepared and wrote the contract, drawings, and specifications intended to express or clearly indicate his requirements in the language used rather than leaving them to be determined by resolving doubts and inferences in his favor."

Special provisions control

One paragraph of the specifications headed "69. Embankment Construction General", gave the contracting officer the authority to determine the "suitability" of materials for embankments. There were many kinds of emembankments required. Another paragraph of the specifications, entitled, "74. Earth Fill in Left Ridge Dam", specifically provided that this fill or embankment "shall consist of the natural mixture of clay, silt, sand and gravel available from the foundation excavation for the Madden Dam" without "separation, sorting or blending."

Other provisions for other fills had similar terms, while still others had the language "*if suitable*" added. Notwithstanding these provisions, the contracting officer, under the supposed authority of Par. 69, decided that Madden Dam excavation was not suitable for the Left Ridge (and certain other fills) and permitted its use only when mixed and blended with materials from other sources. In rejecting the contracting officer's conclusions and allowing the contractor's claim for the extra costs incurred in complying with the unwarranted requirements, the Court said:

> "Any authority granted to the contracting officer under the general provisions of Par. 69 to decide as to the 'suitability' of material was limited to those instances where the subsequent detailed specifications naming the materials the contractor could use, used the words 'if suitable'. We think the proper construction of the general provisions of Par. 69 is that the contracting officer only had authority to decide what materials should be used and whether it was suitable if the numbered paragraphs of the specifications which followed and dealt specifically, and in detail, with the fills, specifying the material to be used, contained the words 'if suitable' or 'if suitable as determined by the contracting officer', or 'as directed by the contracting officer.' In other words, the sentence in the general provision that 'The suitability of all materials for construction of embankments shall be subject to the approval of the contracting officer' was not intended to give him that authority under subsequent specific paragraphs which specifically designated the different sources from which plaintiffs might obtain material, but which contained no provision that the materials so designated could only be used 'if suitable.'"

This is a ruling that will be of use in many cases where a contracting officer looks to a general provision and ignores another controlling the specific situation.

Authorized changes limited

The contract provided one price for concrete below the generator floor with a higher price for that above the floor, the difference being occasioned by the fact that the work below was largely of a mass character while that above was more intricate requiring very expensive formwork.

Long before the powerhouse work was commenced, and continuously thereafter, the Panama Canal authorities issued revised drawings, the combined effect of which was to make the powerhouse, above and below the generator floor, very different from, and the concrete work more expensive than, the work as shown by the original plans. The court in allowing claim for the increased costs caused by the changes said:

> "Plaintiffs timely appealed to the head of the department who also considered the protest and claim on the merits and denied them on the ground that plaintiffs had been paid for the work performed as required by the contract and specifications. Plaintiffs claim that Par. 43 of the specifications, when properly interpreted in the light of Art. 3 and other provisions of the contract, did not authorize the changes here made without a determination of the necessary increased costs and the making of an equitable adjustment in the original unit price applicable to the work before changed. In this they are correct."

Contractors will do well to study the Callahan decision as constituting a guide on what to do or not to do, particularly in the matters of protest notice, appeal, asserting claim, etc.

Delays by the government

The Hirsch case involved a number of contracts in identical form for the construction of a large number of air-beacon towers and a lesser number of landing fields, scattered from Chicago to Atlanta. The contractor planned to do the work in sequence, with a number of crews of men each skilled in its particular functions; one of foundation workers, another of erectors, and so on. One crew completing its work at one location would move on to the next, while a second crew would arrive at the first location, do its work, and move on—no two crews being at the same location at the same time.

Antecedentally, the necessary grading work at all locations was to be done by the government and detailed plans showing the wiring and other layouts were to be given the contractor. After giving the contractor notice to proceed, and thus starting the contract time for performance to run, the government failed to cause the antecedent work of grading to be done promptly or to be done at all in any orderly sequence, and also greatly delayed the issuance of necessary wiring and other plans or specifications.

The contractor made claim for the extra costs incurred by it by reason of having to skip location and jump to others distantly removed, and on other accounts. The government rejected the claim and, before the court, defended its action on the ground, among others, that the contractor had failed to give written notice, as required by the contract, that this or that action by the contracting officer, or failure to act where the contract required him to act, was causing extra expense or delay, and was thereby debarred from asserting claim on such account.

In overruling this contention, the court fixed a long-needed rule of law that is of very great importance. The court stated the rule as follows:

> "It would be an unreasonable interpretation of Art. 9 to hold that after the contracting officer had ordered plaintiff to proceed the contractor should be charged with heavy damages if he did not notify the contracting officer in writing to fulfill his specific promises and comply with his known obligations under the contracts. It seems clear that the proviso with reference to written notice by the contractor within ten days did not apply and was not intended to apply where the contracting officer by a written order to plaintiff stopped all work at

various sites over long periods of time. Even in those cases plaintiff did, within a reasonable time, request the contracting officer by telegram and letter to release the written orders of suspension so that the work could proceed, but the suspension orders were nevertheless continued because the contracting officer had not performed his work or because he could not come to a conclusion as to what changes he wanted to make. In a number of instances the work at various sites was stopped over long periods and finally released without any changes being made. There was no provision in the contracts requiring plaintiff to make a request for specific extensions of time. However, plaintiff did make specific requests for extensions of time, due to delays caused by the defendant, before the work under the contracts was completed and before the contracting officer gave consideration to the matter of extensions of time after completion of the work."

Changed conditions

The contracts each contained the usual "changed conditions" (Art. 4) provision requiring an equitable adjustment of the contract price in the event conditions were encountered different from those represented. But because another provision (in the "Invitation for Bids") required that bidders "must make their own estimate of the facilities and difficulties attending the execution of the proposed contract, including local conditions," the contracting officer refused to make any adjustment on account of changed conditions as encountered. The court disposed of this contention, saying:

"The statement in the invitation for bids must be read in connection with Art. 4 of the contract and, when so read, it is clear that it did not apply and was not intended to apply to unqualified representations contained in the drawings and specifications upon which plaintiff had a right to rely. The plaintiff had a right to assume, when making his bid, that the foundations and towers constructed and erected, as definitely shown and specified by the defendant in the drawings and specifications would properly stand. Par. 2 of the invitation for bids did not require plaintiff to investigate and determine for himself whether or not defendant's engineering conclusions were correct. Art. 4 of the contract took care of such contingencies, and that was the whole purpose of having that article in the contract. In effect, the defendant by Art. 4 of the contract said to the plaintiff 'If you excavate for tower foundations according to the dimensions I have shown and specified, and if you construct the tower foundations in accordance with the dimensions and of the materials shown and specified, I will make an equitable adjustment so as to increase your contract price if it should become necessary, by reason of conditions encountered, to make the excavations or construct the foundations in a different and more expensive manner.' If the statement in the invitation for bids controlled in every circumstance, Art. 4 of the contract would be meaningless.

Art. 4 and 3 of the contract, prepared by the defendant, were intended principally for its benefit in obtaining low bids. One of the purposes of Art. 4 was to relieve bidders of the necessity of having to increase their bid prices so as to take care of all possible unknown and unforeseen conditions and contingencies that might arise in connection with furnishing defendant a perfect job at their own expense. These articles must be interpreted and applied in the light of the facts and circumstances as shown by the record in each case. They should not be arbitrarily interpreted and applied in favor of defendant, so as to relieve it of an expense contemplated by Art. 4. The contracting officer found that the extra work done was necessary, and approved and affirmed the findings and orders of the inspector. It is true that this was after plaintiff had performed the necessary work ordered by the inspector, but we see no reason why the contracting officer could not effectively ratify what had been ordered and we think he did. *Crozier* v. *Krupp*, 224 U. S. 290; *Shoshone Tribe of Indians* v. *United States*, 299 U. S. 476, 496. A slight departure as a mere matter of form or procedure rather than substance is not fatal to plaintiff's rights or to the contracting officer's authority. The work performed was necessary, it was satisfactorily performed at the cost found, and defendant received the benefit thereof. The particular cost was not within the contract price and under the terms of the contract drawings and specifications was not intended by either party that it should be. *Suburban Contracting Co.* v. *United States*, 76 C. Cls. 533, 545; *Sobel* v. *United States*, 88 C. Cls. 149, 161, 162, 168, 169."

The Hirsch decision is an important one and will result in much benefit to future contractors.

Planning Project Enlists Three Levels of Government

A THREE-CITY PLANNING PROJECT to demonstrate results that can be obtained when local, state and federal governments go to work on city planning is underway with headquarters in Johnson City, Tenn., the American Society of Planning Officials reports. Bristol, which straddles the Tennessee-Virginia state line and has two governments, and Kingsport are the other cities in the project. All three are "urban units" — that is, not dominated by a big city nearby, yet concerned with the typical problems of a city. Individually they could not afford to finance full-time city planning.

Main object of the planning experiment, set up by the Federal Housing Administration as a pilot case, is to develop a simple, inexpensive procedure for municipal programs of land-use protection and guidance in real property development. The FHA is interested in discovering social and economic factors that make a city "safe" for small-home investors.

Cooperating with technical assistance are the Tennessee State Planning Commission and the Tennessee Valley Authority. The cities are represented by planning commissions made up of citizens. The municipalities supply office space, equipment and supplies and some of the clerical help. All work done in the Johnson City headquarters is channeled through the city commissions to departments of the cooperating city governments.

The three cities now are undergoing analysis of their economic bases in terms of manufacturing, retail and wholesale trade and agricultural production. Maps showing major uses of the land and population settlement patterns are being made. The administrative machinery of the local governments also is being studied, and an overall survey of public and private welfare, agency by agency, is underway.

Initial surveys and plans will take about two years to complete. Among questions it is hoped they will answer are: What arrangements do modern conditions make necessary in the spacing of land and buildings and the streets that serve them? How many families can live comfortably and economically in a city block or in a neighborhood? Why do the most desirable portions of a city often become blighted and cost the most to maintain? Where should parking places, playgrounds, schools and public buildings be located? Which of the cities' industries will grow, which are permanent, which will probably decline, and what effect will these trends have on the income of the people?

Army Warehouse Design Saves Steel

***Contents in Brief**—Knowing that structural steel was going to be hard to obtain, an unusual design was prepared for six large warehouses to be built at the Voorheesville, N. Y. Regulating Station. The final design, which made possible a large saving of steel, is described, as are the rapid construction methods being followed.*

A SPECIAL DESIGN that greatly reduced the use of structural steel, coupled with careful planning of the building procedure, is making possible rapid construction of six 180x960-ft. one-story warehouses at the War Department's Voorheesville, N. Y., Regulating Station (depot). Thus, while many defense projects have been held up by lack of critical materials, at Voorheesville, 1,000,000 sq.ft. of floor space is soon to be available after four months of work. Major savings in steel have been accomplished by: (1) use of wooden roof trusses; (2) substitution of brick arch lintels for reinforced-concrete or steel lintels; and (3) concrete exterior base walls free of reinforcing steel, although averaging 8 ft. in height. Compared to the type of warehouse that would ordinarily be built, the type of structures actually being constructed will result in a saving of 5,000 tons of steel on the six units.

Design decided upon

The type of warehouse being built calls for gravity type exterior foundations varying in thickness from 2½ ft. at the base to 1 ft. at the top, dependent upon height, which averages about 8 ft. Above the floor level the exterior walls and the fire walls, which run crosswise of the building on 240-ft. centers, are 12 in. thick and of brick. Two rows of reinforced-concrete columns 60 ft. apart and on a 40-ft. spacing are used the long way of the building to make all bays 40x60 ft. The 9½-ft. square 1½-ft. thick column footings are carried down to the same elevation as the exterior walls. Above the footings the column bases taper from 6½ ft. square to 2½ ft. square. From this point to 13 ft. above floor level the columns are 2 ft. square and reinforced with twelve ⅞-in. round bars, but for the remaining 7½ ft. they are 13 in. square and reinforced with four bars.

The roof trusses, which are of relatively standard design built up of 3x12-in. fir timbers, are surmounted by 6x12-in. purlins on about 6-ft. centers and then 2x6-in. tongue and groove sheathing and a 4-ply built-up tar and gravel roof. Instead of steel sash windows, to get early deliveries, windows with wooden frames are used to close off the vertical areas between the two roof elevations. For the floors a 7-in. thick concrete slab reinforced with two layers of wire mesh is used. Along both sides of each warehouse a 16-ft. paved loading platform is being built, as is a 14-ft. wide canopy.

Materials required for one of the structures include: 1,300,000 standard size common clay brick, 5,000,000 board feet of lumber, and approximately 7,000 cu.yd. of concrete.

The arrangement of the roof trusses (Fig. 2), which are 7 ft. deep and fabricated with bolts and split-ring connectors, calls for transverse trusses on 20-ft. center and then similar longitudinal trusses between the columns. The lower chord of these latter trusses provides a 13½-ft. clearance, as do the transverse trusses in the outer bays. However, the lower chord of the transverse trusses spanning the middle bay are at the same level as the top chord of the trusses in the outside bays. Thus, a 20½-ft. clearance is provided along the center bay. Most interesting feature of the truss design is the method of support at the columns, which is shown by an accompanying photo. For details of such a connection see *ENR*, Oct. 23, 1941, p. 597. Where the trusses join the outer walls the brick thickness is increased to 2 ft. to make a 2-ft. square pilaster and to give added bearing capacity. However, where the longitudinal trusses join the end walls and the 12-in. thick fire walls, 2-ft. square reinforced-concrete columns are used. These are built integral with the fire walls, but inside the end walls.

The 9½-ft. square spread footings

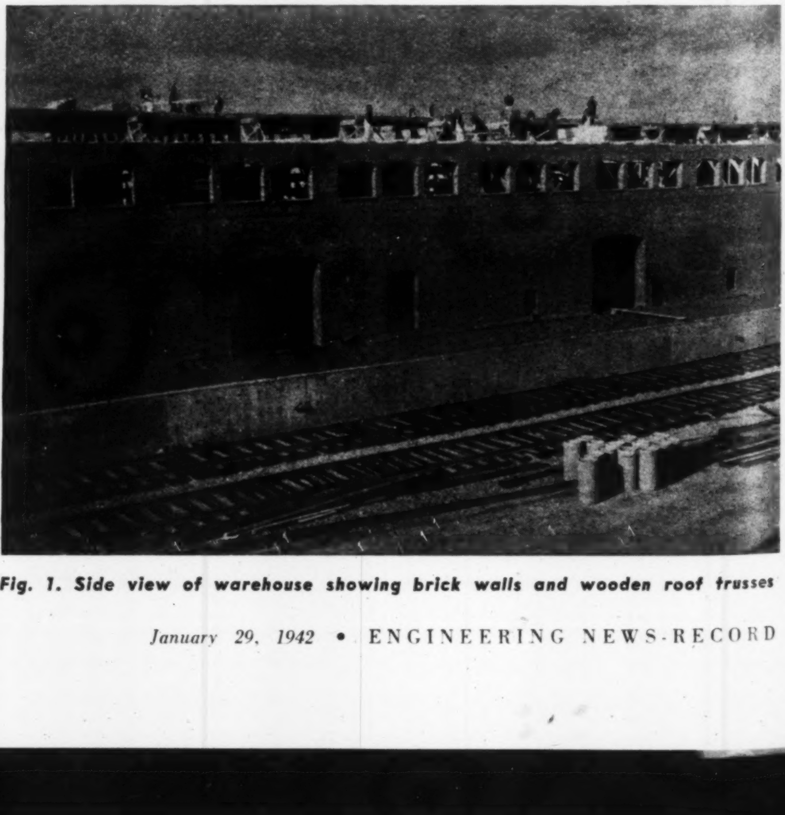


Fig. 1. Side view of warehouse showing brick walls and wooden roof trusses

for the columns are carried down to firm soil. Once these are in place the bases are built up to about 1 ft. below floor level. Next, placing of the 50,000 cu.yd. of earthfill required for each warehouse is begun. The fill is spread by bulldozers, compacted by rollers, and carried up to near its final height. Although much fill is needed in the areas where the exterior walls are being built, it is possible to place much concrete for those walls by having the transit-mix trucks move up onto the fill in place and dump their loads directly into chutes discharging into the forms. Thus placing the earthfill first makes possible a great labor-saving in constructing the lower walls.

Once the fill and the concrete portion of the exterior walls are in place, crews immediately start to lay brick for the upper walls and to construct the concrete floor slab, which is placed directly on the fill.

Floors paved in 10-ft. widths

The floor slab is being put down in 10-ft. wide strips running the long way of the building and with expansion joints every 80 ft. All concrete is supplied as transit mix from a central plant and it is mechanically spread. A crew of 75 men, exclusive of truckdrivers, using two spreaders in eight working days is able to place the concrete for the entire floor of one building, which is equivalent to constructing 3½ miles of 10-ft. wide pavement. For this work, as with all concrete work, once cold weather arrived, all aggregate and water for the concrete is heated by means of an obsolete locomotive.

An average force of 200 bricklayers in 13 working days is able to lay the bricks for the exterior walls of one warehouse—despite the fact that construction of brick arch lintels is required for 376 openings, varying in size from 10x13 ft. to 3½x4½ ft., for each building. Many days on portions of the walls where there are no

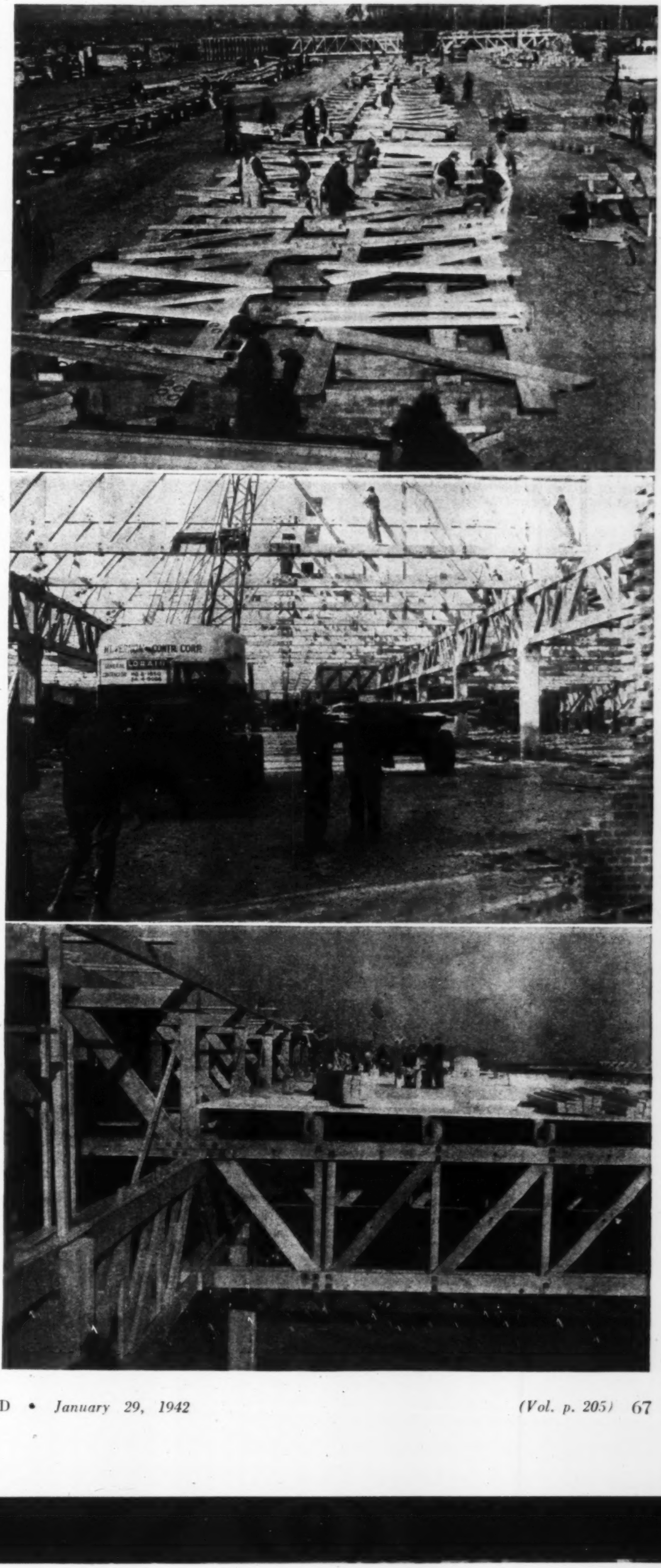


Fig. 2. At top roof trusses are being assembled, with 2½-in. diameter split ring connectors, from fir lumber cut and marked for position before being shipped to the site. Truck crane erects trusses with transverse members for center bay going up last. Details of truss joints and roof construction are given by bottom view, which is looking long way of building.

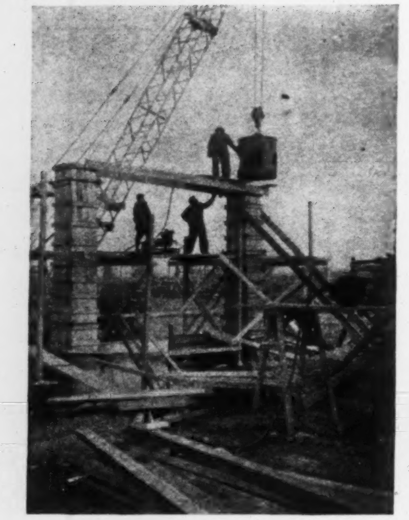


Fig. 3. Concrete for columns is delivered as transit mix, placed with a 1-yd. bucket handled with a truck crane, and then vibrated in place.

openings bricklayers average 900 bricks apiece in the eight-hour day. In the last stages of construction when cold weather was encountered, much of the brick work was enclosed with light frames covered by blankets and the area heated with steam from an obsolete locomotive.

In constructing the reinforced-concrete interior columns two concrete pours are required. First the columns are completed to the top of the brackets and then a few days later the remaining 7 ft. of height is added. All forms are of wood and the practice is to place in one continuous operation the concrete for all columns of one building. The transit-mix concrete is delivered to the forms in 1-yd. buckets handled by truck cranes. In building the columns a crew of 40 men in six working days can assemble the forms, place the concrete, which is vibrated in place, and strip the forms from all 46 interior columns required for one warehouse.

In assembly of the roof trusses truck cranes operating in the middle bay first erect the trusses running the long way of the building. These each weigh about 2½ tons and once they are in place, the crawler moves into one of the outer bays and starts erecting the transverse trusses, which average about 3 tons each. Once the longitudinal trusses and the outer transverse trusses are in place, the tranverse trusses for the middle bay can be erected. These units also weigh about 3 tons. All the trusses are delivered by trailer trucks and the most satisfactory method is for the trucks to enter one end of the building by a ramp and leave at the other end. Where brickwork on the firewalls is started before truss erection is complete, openings are always left in the fire walls for all equipment to move through. A single truck trailer and a crew of about 15 men, exclusive of the truck drivers and the loading crews, can erect 45 trusses daily.

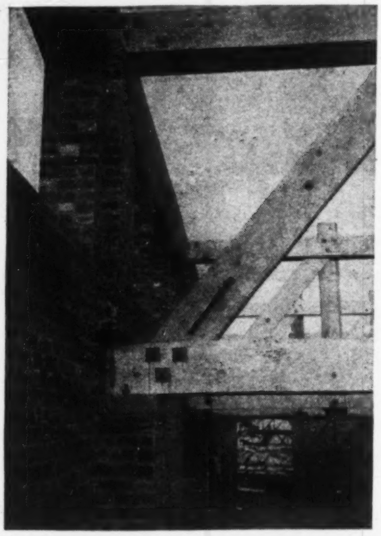


Fig. 4. Exterior ends of transverse trusses are carried by walls, which are widened to make 2-ft. square pilaster. The spare bolt shown is inserted through the seat angles which go on the oak pillow blocks.

All trusses are assembled on the site but the lumber is delivered precut with all the holes bored. Also each piece is marked for which one of the three types of trusses it is to be used and as to the correct position in the truss. All trusses are assembled lying flat and one carpenter and one helper in an 8-hour day can assemble one truss with all bolts tightened by hand.

In constructing the roof all operations are by hand except for cranes placing the purlins on the trusses or completed portions of the roof.

Warehouses completed in 4 months

Preliminary work on the $7,900,000 Voorheesville project, for which the warehouses account for about 50 percent of the cost, was started Aug. 19 and Sept. 17 trenching for the first warehouse was begun. Dec. 15 the first structure was ready for occupancy and all six warehouses were expected to be ready for use Jan. 15. This was possible despite the fact that the work was complicated by simultaneous construction of 20 miles of permanent railroad, 8 miles of roads, a sewage disposal plant, a water supply, and 2,000,000 sq.ft. of outside storage space. In addition 950,000 cu.yd. of excavation was necessary. Two shifts were employed on the earthwork and constructing the floor slabs. Of the peak force of 5,500 workmen about 3,000 were employed on the six warehouses.

Those in charge

For Zone II of the Constructing Quartermaster Corps work, of which the warehouse construction is a part, Col. M. A. McFadden is Zone Constructing Quartermaster, and Capt. A. E. Perkins, Constructing Quartermaster, and Lt. J. F. Sally, executive officer, at Voorheesville. The New York Central R.R. is the architect-engineer and all design was done by that firm under the supervision of Julius W. Pfau, chief engineer, while Thomas P. Lynch is resident engineer. The joint firm of Duffy Construction Corp., Inc., and the Carleton Co., both New York companies, with Edward J. Duffy, project manager, Alexander S. Reid, general superintendent, and T. F. Keller, office engineer, holds the general contract.

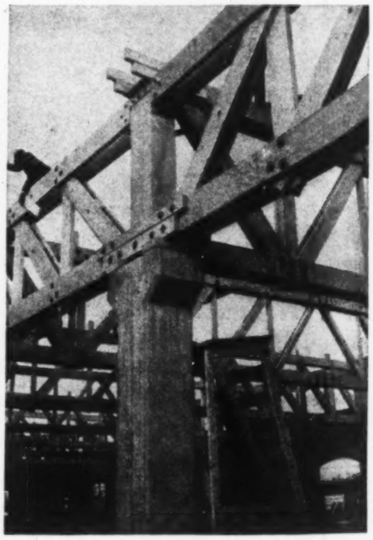


Fig. 5. This is typical truss framing at reinforced-concrete columns. When transverse truss for center bay is erected it will rest on chord on which man is working.

From Field and Office

Working problems and time-saving methods for engineers and contractors

Chart for Spacing Stiffeners

The accompanying chart provides a simple and rapid means for obtaining the spacing for intermediate stiffeners for plate girders. The chart is platted for:

$$d = 270{,}000\sqrt[3]{\frac{t^4}{hv^2}}\text{, where}$$

d = clear distance between stiffeners in inches

t = thickness of web plate in inches

h = clear depth between flanges in inches

v = web shear in pounds per square inch

The formula given agrees with

$$270{,}000\ t\sqrt[3]{\frac{vt}{h}},$$

as given on pp. 124 and 125 of A.I.S.C. Handbook, third edition, fourth printing.

To use the chart, calculate the web shearing stress, in pounds per square inch, at various points along the girder where stiffener spacing is to be determined. Select a web plate of proper thickness so that the maximum shear does not exceed 12,000 psi. and the ratio $\frac{h}{t}$ does not exceed 170. Draw a straight line from a thickness of web plate on the t scale to the clear distance between flange angles on the h scale. If the line intersects the d scale to the right of the line for $\frac{h}{t} = 70$ no intermediate stiffener angles are required. If the line intersects the d scale to the left of the line for $\frac{h}{t} = 170$ the web plate is too thin.

If the line intersects the d scale between $\frac{h}{t} = 70$ and $\frac{h}{t} = 170$, proceed as follows: From the intersection of the line connecting t and h with the pivot scale draw a straight line to a point on the v scale representing unit shearing stress at the point under consideration. The intersection of this line with the d scale shows allowable clear distance between stiffeners. Where the web shear is less than 2,200 psi., no intermediate stiffeners are required, regardless of the ratio $\frac{h}{t}$.—M. J. MARCUSON, *structural engineer, Batavia, Ill.*

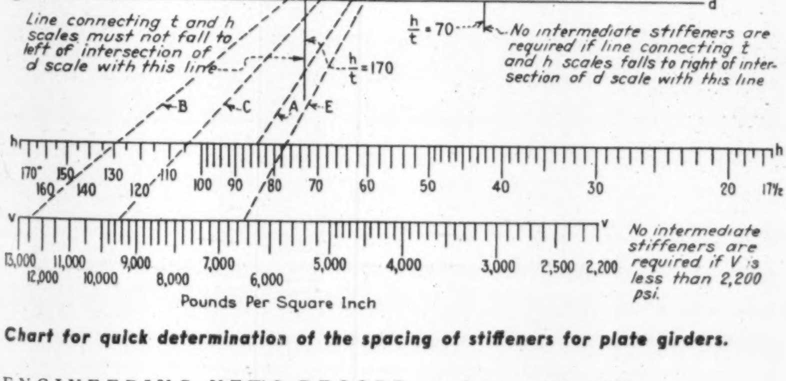


Chart for quick determination of the spacing of stiffeners for plate girders.

X-Ray Darkroom Moves With the Job

A portable darkroom that moves along the penstocks on Shasta Dam.

Field joints in the 15-ft. penstocks now being installed in Shasta Dam are X-rayed before the work is approved. To speed up this operation, it is desirable to have some readily accessible place to develop negatives. Accordingly, the contractor on this X-ray operation (Industrial X-Ray Laboratories, Inc., Seattle) has built a portable darkroom designed to be picked up by the overhead cableway from time to time and moved along the penstock line.

Convenient plugs are provided for electric and water supply services so that after each move these two utilities can be quickly connected. The door is light-tight, of course, and there are no other openings. All necessary darkroom facilities are provided and negatives are ready for inspection right on the job before the welder goes off shift.

Tangents to Vertical Curves

In the article by William E. Cooper in *ENR*, Sept. 11, 1941, p. 103, entitled "Finding Tangent Slopes on Highway Vertical Curves," Mr. Cooper does not fully point out the advantages of this method of computing points on the parabolic curve. Using the nomenclature adopted by Mr. Cooper

$$C = -\frac{MN}{L_1^2} \text{ or } -\frac{(G_1 - G_2)}{2L}$$

$$Y \text{ maximum} = \frac{G_1^2}{2(G_1 - G_2)}L$$

Y maximum occurs when

$$X = \frac{G_1}{(G_1 - G_2)}L$$

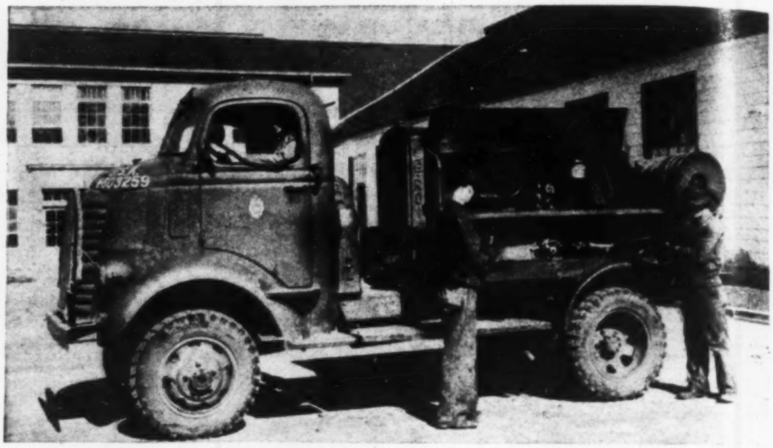
For this point on the vertical

curve the equation then becomes

$$Y = CX^2$$

This can be read from a single setting of the slide rule. When values of X become large it requires longhand or machine calculation to arrive at values of Y sufficiently close for bridge bearing plates.

Most of the engineers in the grade separation office of the Illinois Division of Highways had a hand in the development of the method as used there during the past three years.—CHARLES MACKLIN, *Normandy, Mo.*



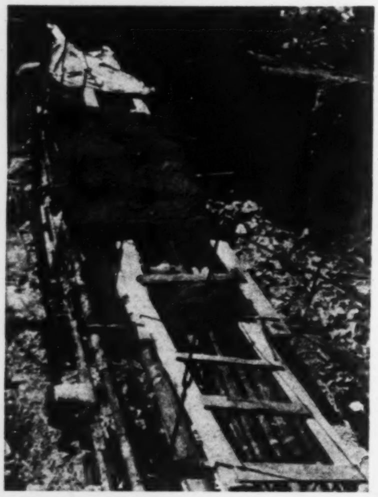
MOBILE COMPRESSOR AND AIR-TOOL UNIT FOR THE ARMY

To make the advantages of compressed air tools easily available to the U. S. Army, the Corps of Engineers has adopted an assembly of equipment well known to construction for use of engineer troops. As indicated, the unit consists of a truck-mounted compressor with a complete set of tools, including drills, clay spades, tamps, sheetpile driver, saws, a 175-gpm. sump pump and spray-paint equipment. The compressed air is also available for inflating truck and equipment tires.

MAINTAINING SERVICE IN LIVE PIPES DURING CONSTRUCTION

Workmen of Daniel J. Rice, Inc., heating engineers and contractors of New York, prevented disturbance of live mains in a pipe tunnel during the tunnel's demolition by constructing the steel-cable bridge shown. Suspenders equipped with turnbuckles support light steel beams to which in turn are attached the pipe hangers, as illustrated.

The maintenance problem arose in excavating under the tunnel for a new structure. — ARTHUR M. DOENECKE, project clerk, Daniel J. Rice, Inc.



Cased Drill Holes

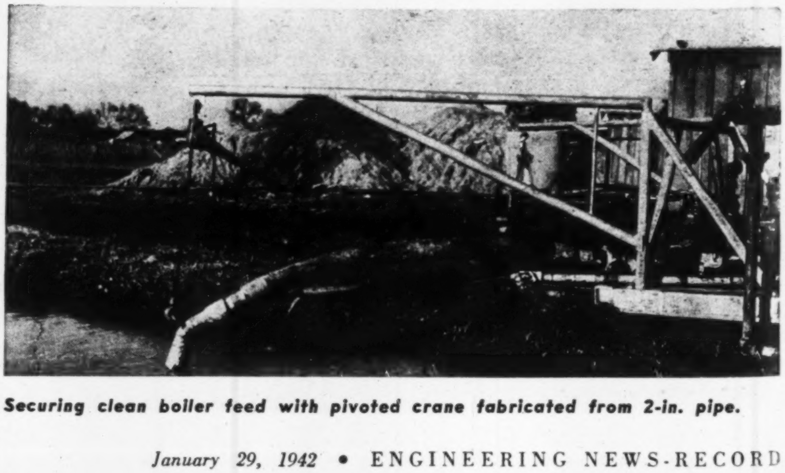
Discarded steel-tube conduit used by electricians proved highly successful on a recent flood-control operation in keeping small-diameter drill holes in shaky rock open for loading. At first wood doles were placed in the bad holes, but they worked well only when the rock was dry. In wet holes the water expanded the wood fibres or sand, mud or drill sludge were packed in so tightly by the vibration of adjacent drilling that withdrawal of the doles was difficult.

One day the blaster in desperation picked up a piece of steel tube thrown aside by the project electricians. This he had the blacksmith heat in the forge and beat one end to a point on the anvil. Then the other end was flared out slightly to prevent the sides from tending to cave in when the tube was driven into the hole by a wooden mallet. The device worked well; not only did the tube keep out all foreign matter but it also made a fine loading tube for the explosive charge. Such cased holes broke a maximum of rock and reduced the number of holes required.—MYRON CARL, *Milwaukee, Wis.*

Pivoted Crane Insures Clean Boiler Feed

By slinging the end of the boiler feed pump from a pivoted crane fabricated from two-inch pipe and inserting a hoist in the lift line, it is possible to keep the foot valve and strainer clear of the mud and draw water from the clearest portion of the reserve. Use of the crane and hoist also permits ready inspection or cleaning of the foot valve without roiling or disturbing the pit bottom.

Also, supporting the suction hose near its end with the foot valve in a nearly vertical position permits full absorption or dampening of suction pulsations before they can reach the pumps and possibly impair valve action.—M. T. PATE, *Houston, Tex.*



Securing clean boiler feed with pivoted crane fabricated from 2-in. pipe.

Book Notes and Reviews

The month's addition to the engineer's reading and reference list

Surveying Instruments

GURLEY MANUAL OF SURVEYING INSTRUMENTS—49th Edition. 208 pp. W. & L. E. Gurley, Troy, N. Y. Price 50c.

After a lapse of 20 years, W. & L. E. Gurley have brought out the 49th edition of a little manual that was well known to field men of two or three decades ago. The new book brings together data contained in separate service booklets published in the intervening years. About two-thirds of its content is given over to the care and adjustment of surveying instruments, and the latter part relates to astronomy in surveying and meridian determination. Tables for use in meridian determination, tables of logarithms, of natural and logarithmic functions and other tables used commonly in surveying are included.

Bridge History

BRIDGES AND THEIR BUILDERS—By David B. Steinman and Sara Ruth Watson. 380 pp. Published by G. P. Putnam's Sons, New York. Price $3.75.

Starting with a description of man's first attempts at bridge building, this book is an interesting account of bridge construction down through the ages. The book's first part is given over to advancement prior to the 18th Century, the second part to development of engineering as a science, the third tells of pioneer bridge builders, while a fourth part is concerned with 20th Century bridges and their builders. By such a treatment the authors have not only assembled material that will be of special interest to bridge engineers, but they have written a book that will appeal to the civil engineering profession as a whole. Likewise, the book is so written and illustrated that it will be of interest to many outside the profession.

In describing the construction of the world's outstanding bridges not only are the actual construction details given but many other problems encountered in making the project a reality are described. These relate to financing, land acquisition, criticism from the laymen, and opposition by local political bodies or organized groups. Although this at times slows up the reading, it adds value by emphasizing that the bridge builder often has important problems besides those encountered in design and construction.

As the publication's title signifies, a great deal of space is also given to the life history of the engineers in charge of many outstanding bridge projects. The book is noticeably lacking in the space given to vertical lift, bascule and swing bridges and their builders. However, despite this failing, it should be a useful addition to the civil engineer's library.

Reading for Engineers

THROUGH ENGINEERING EYES—By Allan R. Cullimore. 166 pp. Pitman Publishing Co., New York and Chicago. Price, $1.50.

This book of pocket size contains extracts from the writings of 27 famous men translated into English by various authorities and in most cases bearing directly or indirectly upon the development of scientific and engineering thought. The period from 1000 B.C. to the present century is represented, but most of the space is devoted to the period preceding the birth of Christ. The longest article consists of interesting quotations from the Greek traveler and historian, Herodotus, who lived in the fifth century B.C. and from whose writings are obtained the most definite information available upon many matters of ancient customs; but Homer, Archimedes, Caesar, Roger and Francis Bacon, Leonardo, Cellini and Ben Franklin are also allotted considerable space.

Each extract is preceded by a brief statement concerning its author and these statements are among the more valuable features of the book. It is to be regretted, however, that the introductory paragraph, in the case of Leonardo da Vinci fails to do justice to his achievements as an artist. In the writer's opinion it should have included mention of his famous paintings, Mona Lisa and The Last Supper.

The compiler states that the selections have been taken from books which he has read and enjoyed, and a perusal of the volume furnishes convincing evidence of his own high taste. The book should prove of interest to all readers and be of especial value to scientific and engineering students, as well as to older and wider-read members of these professions.—*Reviewed by* C. M. SPOFFORD, *consulting engineer, Boston, Mass.*

Indeterminate Analysis

RELAXATION METHODS IN ENGINEERING SCIENCE—By R. V. Southwell. 252 pp. Clarendon Press, Oxford, England. Price $5.

The relaxation method as described by the author is similar to the method of moment distribution widely used in this country for the analysis of continuous beams and extended in American literature to trusses, to continuous arches, to electrical and hydraulic distribution systems, etc. The method as presented is intended only for analysis. The fact that such procedures may be readjusted to provide completed designs receives no mention in this volume.

The book starts with a discussion of pin-connected frameworks or statically indeterminate trusses. The author's relaxation procedure is stated by him to be *a means whereby simultaneous equations may be solved, not exactly, but with steadily increasing approximation.* As such, the procedure shows up least effectively for the analysis of pin-connected frames which seldom require the solution of more than two or three simultaneous equations. The method becomes increasingly useful as the number of simultaneous equations increases.

American procedure has been to apply distribution methods informally, but the author's system is highly formalized. Hence, the author relinquishes the possibility of many simplifications for the advantages of standardization. The justification is that the author is interested in developing a single procedure that can span the wide group of problems presented in the text, that is, truss analysis, girder analysis, frame analysis, the adjustment of errors, electrical networks, vibrating systems, elastic stability, etc.

Another point worth emphasis is that the book treats the relaxation method as a mathematical procedure. The conception common in American writings that these methods of successive corrections may be arranged so that each recorded term represents a physical action of the structure is not considered important in this book. This may explain why the author finds it difficult to describe the procedure in simple terms. Hence, one should not expect to read this book except through hours of careful study. In fact, the book seems more involved with recording research accomplishments than in teaching a new method of analysis.

The merit in the author's approach to analysis lies in the integration of several fields within one framework or procedure. It has been too common to isolate a subject, such as vibration or truss analysis, and treat it as a separate problem unrelated and unassociated with other problems in structures or machines. If the American engineer will study this book and interpret its ideas into engineering terminology as used in this country, he will find that he has at hand a powerful tool of analysis.—*Reviewed by* L. E. GRINTER, *dean, Graduate School, Illinois Institute of Technology, Chicago.*

Water Operators' Manual

WATER PURIFICATION FOR PLANT OPERATORS—By George D. Norcom and Kenneth W. Brown. 180 pp. McGraw-Hill Book Co., New York and London. Price $2.50.

Training men to operate plants has been one of the special responsibilities of Messrs. Norcom and Brown, who are consulting and sanitary engineers, respectively, for private water companies. They are intimately acquainted with the operator, and they know his capabilities, his limitations and his troubles. With this background they have written an excellent book on the job to be done and the most satisfactory way of doing it.

Here is a practical manual, devoted solely to water plant operation, and it is tailored exactly for the needs of "short course" and defense training classes. Both theory and practice are discussed, but in a manner that is sympathetic to those who have not had the benefit of a technical education. The text is stripped of academic verbiage so that it is rapid-fire in its coverage of salient matters, and the authors are positive in their statements, thus eliminating any possibility of misinterpreting what they consider to be the best methods, based on proven experience. One of the most valuable features of the book is the "self-examination" or quiz pages, which follow each of the 15 chapters.

Business Facts

THE ECONOMIC ALMANAC FOR 1941-42—451 pp. The National Industrial Conference Board, 247 Park Ave., New York City. Price $4.

Something new in the way of statistical information was attempted two years ago when the National Industrial Conference Board brought out its first "Economic Almanac." The 1941-42 issue is an amplification of that earlier undertaking, a compilation of the most dependable statistics about government, business and labor, many of which are not elsewhere obtainable in any such convenient form, if at all. Included are chronologies of business, political and labor events in 1940-41; brief outlines of the principal normal and wartime agencies of the government, with their functions; a section on industrial and labor relations; a section on general business conditions subdivided into production and trade, manufacturers' operations, foreign trade, employment and unemployment, wholesale commodity prices, cost of living, banking and finance, output of major industries; and a section on recent economic developments. The latter section contains considerable information concerning the construction industry.

Miscellaneous Notes on Booklets and Reprints

RECOMMENDED DEFINITIONS OF TERMS used in surveying and mapping are included in a progress report issued Dec. 5 by the Federal Board of Survey Maps, North Interior Department Building, Washington, D. C., from which agency copies of the report can be obtained.

CURTAILMENT OF NON-DEFENSE EXPENDITURES is the subject of a pamphlet just issued by the Brookings Institution, Washington, D. C. (25c.). Included is a discussion of defense and non-defense expenditures of the government and recommendations as to where reductions can be made. Among the projects for which the report finds no justification in the present emergency are the St. Lawrence seaway, the Florida ship canal, and the Tombigbee barge canal, projects totaling over $500,000,000.

REVISIONS of "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings," and the "Code of Standard Practice for Steel Structures Other Than Bridges," have been made by the American Institute of Steel Construction, 101 Park Ave., New York. Copies of either document may be obtained from the Institute for ten cents.

TO MEET THE REVIVED INTEREST in timber for bridge on culvert work resulting from the priorities on steel, the West Coast Lumbermen's Association, 364 Stuart Building, Seattle, Wash., has brought out a pamphlet "Highway Structures of Douglas Fir" which gives, largely by drawings, information on the design of a variety of timber bridges, culverts and guard rails. Laminated decks, composite timber-concrete decks are covered as well as glued laminated arches.

New Engineering Books

AMERICAN HIGHWAY POLICY—By Charles L. Dearing. 286 pp. The Brookings Institution, 722 Jackson Place, Washington, D. C. Price $3.

TEXTBOOK OF THE MATERIALS OF ENGINEERING—By Herbert F. Moore. Sixth Edition. 454 pp. McGraw-Hill Book Co., New York and London. Price $4.

STEEL CONSTRUCTION — Fourth Edition. American Institute of Steel Construction. 416 pp. Published by the Institute, 350 Fifth Ave., New York. Price $2. To supplement this book the Institute has also published "National Emergency Steel Specifications—Simplification of Structural Steel Shapes" (25c).

INTERIOR ELECTRICAL WIRING AND ESTIMATING—Third Edition. By Albert Uhl, Arthur L. Nelson and Carl H. Dunlap. 354 pp. American Technical Society, Drexel Ave., at 58th St., Chicago, Ill. Price $2.50.

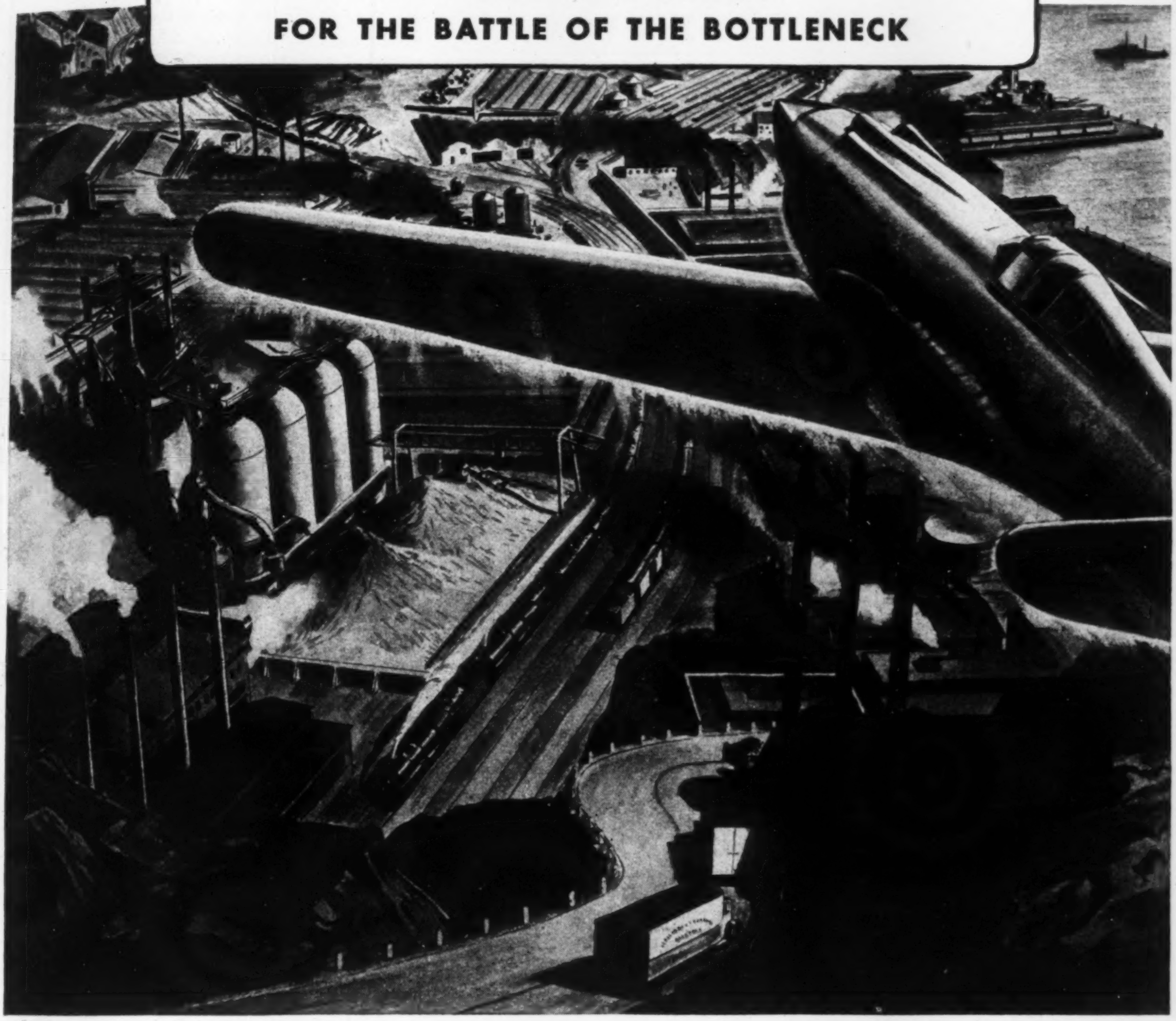
HOW TO DESIGN AND INSTALL PLUMBING—By A. J. Matthias, Jr. 442 pp. American

(*Continued on p.* 76)

EXIDE-IRONCLADS PROVIDE

POWER

FOR THE BATTLE OF THE BOTTLENECK



"NO STOPPAGE . . . *anywhere!"*, is the war-cry in the Battle of the Bottlenecks. Important materials for National Defense must be delivered to the right spots . . . at the right times!

Naturally, that applies to minerals and ores, where dependable Exide-Ironclads keep trammers and locomotives rolling at a swift *American Pace.* The power of Exide-Ironclad Batteries is delivered at a voltage that assures greater hauling speeds, their rugged assemblage keeps maintenance cost down *low.* Year in and year out, more Exide-Ironclads are used underground than all other batteries combined. There's got to be a reason for a record like that!

THE ELECTRIC STORAGE BATTERY CO., Philadelphia
The World's Largest Manufacturers of Storage Batteries for Every Purpose
Exide Batteries of Canada, Limited, Toronto

Exide
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IRONCLAD
BATTERIES

CONTRACT UNIT PRICES

What contractors are bidding on different kinds of construction work

BLUESTONE DAM
WEST VIRGINIA

OWNER: War Department, U. S. Engineer Office, Huntington, W. Va. Major F. H. Falkner, District Engineer.

PROJECT: Construction of Bluestone Dam, a concrete gravity type structure, in the New River, about 0.6 mile above the junction of New and Greenbrier Rivers, near Hinton, W. Va. Dam to contain overflow section, outlet works, and power house intake section. Crest length about 2,060 ft., maximum height 180 ft. above foundation rock. Spillway to have crest length of 790 ft. Outlet works to be in spillway and consist of eight sluices, each with cast iron sluice gates; and two sluices each with a cast iron sluice gate and 48-in. needle valve. Intake section to have six steel penstocks for connection with power house.

CONDITIONS: Project has been assigned priority rating of A-2. Government to furnish emergency bulkhead for sluices, sluice gates, conduit linings and deflector plates, needle valves, crest gates, skim gate and trash chute emergency gate, oil pressure pumps, and drainage sump pumps. Contractor to furnish balance of material and complete work in 900 calendar days. Power house is to be constructed under another contract while work under this contract is being prosecuted. Bid price subject to adjustment for increases or decreases in direct labor and material costs, based on Bureau of Labor Statistics indexes of material prices and building labor rates. Rail and highway transportation facilities available. Wage rates are: skilled labor, $1.00 to $1.50 per hr.; semi-skilled, 40 to 80c.; and common labor, 55c.

BIDS: Three bids were opened December 23, 1941, ranging from the low of $10,195,575 to $11,722,750. Engineer's estimate, $9,749,826.

LIST OF BIDDERS:

1. Seaboard Constr. Corp., Mt. Kisco, N. Y.	$10,195,575
2. Dravo Corp., Pittsburgh, Pa. (contract)	11,376,080
3. B. Perini & Sons, Inc., and Rugo Constr. Co., Inc., Framingham, Mass.	11,722,750

Item	Quan.	Unit Prices (1)	(2)	(3)
1. Cofferdams	L. S.	$494,200.00	$656,000.00	$700,000.00
2. Excavation, common	66,000 c. y.	.60	1.50	6.00
3. Excav., rock; above El. 1380	54,000 c. y.	3.50	2.50	6.00
4. Excav., rock, below El. 1380	203,000 c. y.	2.50	2.00	6.00
5. Excavation, foundation preparation	5,000 c. y.	15.00	5.00	7.00
6. Line drilling, rock	54,000 s. f.	1.00	.60	.75
7. Random fill	46,000 c. y.	.60	1.00	.15
8. Compacted fill	18,000 c. y.	1.00	1.60	.25
9. Rock paved gutters	220 c. y.	12.00	12.00	8.00
10. Rock surface treatment, per coat	1,000 sq.	10.00	7.00	25.00
11. Drilling 3-in. holes	13,000 l. f.	1.00	2.00	1.95
12. Drill 2½-in. holes	16,000 l. f.	.80	1.00	1.95
13. Drill 30-in. inspection wells	280 l. f.	50.00	30.00	40.00
14. 6-in. cores in concrete	1,000 l. f.	10.00	10.00	6.00
15. 12-in. cores in concrete	200 l. f.	20.00	15.00	12.00
16. Class A concrete	19,000 c. y.	20.00	20.00	17.35
17. Class B concrete	110,000 c. y.	10.00	13.00	12.40
18. Class C concrete	821,000 c. y.	7.30	8.00	7.50
19. Unload, haul and store cement	1,000,000 bbl.	.15	.15	.10
20. Furn. and install rein. steel	6,160,000 lb.	.05	.06	.05
21. Misc. steel, furnish and install	385,000 lb.	.25	.30	.15
22. Struct. steel, furn. and install	1,520,000 lb.	.12	.17	.15
23. Bronze, furn. and install	16,500 lb.	1.25	1.00	.40
24. Corrosion resisting bolts	1,300 lb.	.50	1.50	1.00
25. Rails for gantry and push car	196,000 lb.	.04	.10	.05
26. Timber work	1 M bm.	150.00	300.00	200.00
27. Copper water stops	50,000 lb.	.70	1.00	.40
28. Electrical system	L. S.	90,000.00	84,000.00	38,000.00
29. Electrical conduit	200,000 lb.	.10	.30	.18
30. Ornamental metal work	L. S.	7,200.00	10,000.00	6,000.00
31. Roofing and waterproofing	L. S.	3,000.00	4,000.00	1,250.00
32. Needle valves and accessories installed	65,000 lb.	.06	.04	.02
33. Tile gage, furn. and install	L. S.	1,200.00	1,600.00	1,000.00
34. Install sluice gates and all conduit linings	2,200,000 lb.	.03	.03	.025
35. Install crest gates and accessories	4,250,000 lb.	.03	.03	.02
36. Install oil pressure and sump pumps	25,000 lb.	.08	.04	.05
37. Inst. emergency bulkhead for sluices	84,000 lb.	.03	.04	.03
38. Plumbing system fixtures	L. S.	1,000.00	1,000.00	4,000.00
39. Oil, furnished and system filled	8,200 gal.	1.25	.60	.40
40. Black steel pipe	303,000 lb.	.10	.14	.06
41. Wrought iron pipe	158,000 lb.	.15	.24	.13
42. Cast iron pipe	12,500 lb.	.20	.12	.10
43. Brass pipe	200 lb.	2.00	1.50	.35
44. Malleable iron pipe fittings	7,400 lb.	.40	1.00	.50
45. Cast iron pipe fittings	54,500 lb.	.30	.24	.12
46. Steel pipe fittings, incl. companion flanges	37,000 lb.	.25	.60	.25
47. Brass pipe fittings	900 lb.	2.00	1.50	.75
48. Piping accessories	16,000 lb.	.30	.60	.25
49. Valves, straightway, 1500-lb. pressure, semi-steel, 2½-in	2 ea.	160.00	150.00	200.00
50. As above, 1½-in	56 ea.	60.00	50.00	75.00
51. As above, four-way, 1½-in	10 ea.	110.00	120.00	150.00
52. 18-in. automatic drainage gate	1 ea.	100.00	100.00	100.00
53. Valves, swing check, high pressure, 2½-in	2 ea.	60.00	80.00	100.00
54. Hydraulic gage, 1600-lb., 6-in. dial with gage cock	12 ea.	25.00	40.00	30.00
55. Floor stand, painted column, japanned wheel, no indicator, 32-in., with ex. stem	1 ea.	40.00	60.00	250.00
56. Gate and swing check valves, 3½-in. and larger	7,200 lb.	.50	.50	.45
57. Valves, cocks and faucets, brass and bronze	100 lb.	2.00	3.00	1.25
58. Valves, angle and globe	4,900 lb.	2.50	.60	.40
59. Iron cocks	200 lb.	2.00	.50	1.00
60. Highway guard rail	400 l. f.	4.00	3.00	2.00

SEWERAGE SYSTEM
WAYNESVILLE, MO.

OWNER: Defense Public Works Division of the Federal Works Agency, Kansas City, Mo. Russell & Axon, Inc., St. Louis, Mo., consulting engineers.

PROJECT: Construction of a sanitary sewage collection system in Waynesville, Mo. (Contract 2, Docket No. 23-110.) Involves furnishing and laying of 30,800 feet of vitrified clay pipe, all necessary cast iron pipe, manholes, all excavation and backfill, and construction of pumping station.

CONDITIONS: Contractor to furnish all materials and complete work in 100 calendar days. Highway transportation available to site of work. Wage rates are: skilled labor, $1.25 to $1.50 per hr.; semi-skilled, 65 to 85c.; common, 55c.

BIDS: Four bids were opened November 28, 1941, ranging from the contract low of $73,895 to $106,768.

LIST OF BIDDERS:

1. E. J. Fischer, St. Louis, Mo. (contract)	$73,895
2. Samuel Kraus Co., St. Louis, Mo	80,163
3. R. W. Vaught, Camdenton, Mo	106,272

Item	Quan.	Unit Prices (1)	(2)	(3)
1. 12-in. vitrified clay pipe	2,600 l. f.	$0.90	$0.75	$0.78
2. 10-in. vitrified clay pipe	8,200 l. f.	.80	.65	.65
3. 8-in. vitrified clay pipe	20,000 l. f.	.70	.50	.53
4. 10-in. cast iron pipe	375 l. f.	4.00	2.75	5.60
5. 8-in. cast iron pipe	100 l. f.	3.00	2.20	3.36
6. 6-in. cast iron pipe	200 l. f.	2.00	1.60	2.24
7. Cast iron specials	500 lb.	.10	.25	.22
8. 14-in. encasement	100 l. f.	10.00	2.00	
9. Standard manholes, complete	117 ea.	75.00	100.00	154.56
10. Additional depth, manholes	280 l. f.	10.00	15.60	16.80
11. Drops for manholes	4 ea.	25.00	15.00	16.80
12. Standard lampholes, complete	6 ea.	40.00	32.00	22.40
13. Excav. and backfill, 0–6-ft. stage	12,800 c. y.	1.30	2.10	2.86
14. Excav. and backfill, 6–10-ft. stage	2,300 c. y.	1.40	2.20	5.87
15. Excav. and backfill, 10–14-ft. stage	500 c. y.	3.00	2.75	8.40
16. Excav. and backfill, 14–18-ft. stage	110 c. y.	3.00	5.00	12.32
17. Excav. and backfill, 18–22-ft. stage	15 c. y.	5.00	7.00	14.00
18. Rock excavation	225 c. y.	15.00	12.00	13.16
19. Concrete encasement	900 c. y.	2.00	1.00	1.49
20. 12x6-in. wyes and plugs	20 ea.	5.00	4.55	2.82
21. 10x6-in. wyes and plugs	110 ea.	4.00	2.80	1.64
22. 8x6-in. wyes and plugs	450 ea.	3.00	2.25	1.57
23. Pumping station, complete	L. S.	7,000.00	5,684.40	1,211.84

'INCOR' KEEPS WINTER WORK ON SUMMER SCHEDULES

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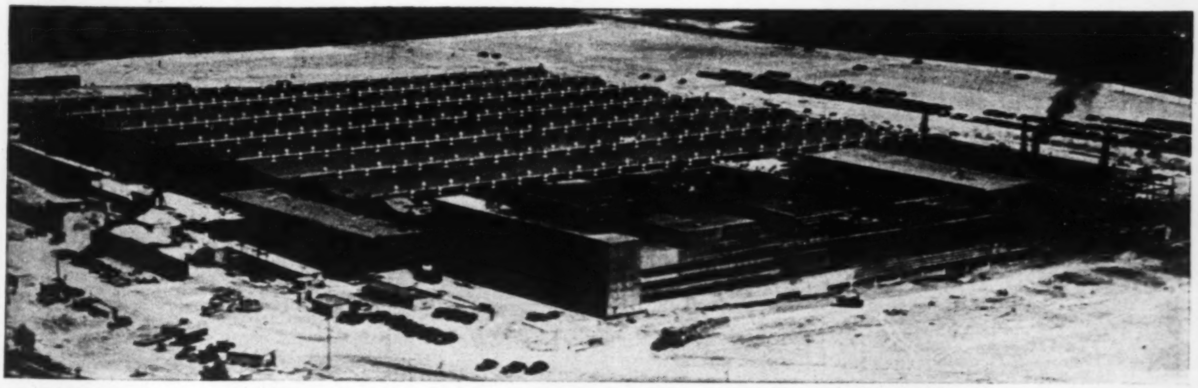
Glenn L. Martin Company Plant No. 2, Middle River, Md.
Architect and Engineer: Albert Kahn, Inc., Detroit
Concrete Contractor: Consolidated Engineering Co., Baltimore



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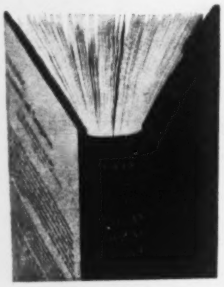

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VOLUME I

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New Engineering Books

(Continued from p. 72)

Technical Society, Drexel Ave., at 58th St., Chicago, Ill. Price $3.

√AEROPHOTOGRAPHY AND AEROSURVEYING—By James W. Bagley. 324 pp. McGraw-Hill Book Co., New York and London. Price $3.50.

REFUSE COLLECTION PRACTICE—Committee on Refuse Collection and Disposal. 659 pp. American Public Works Association, 1313 E. 60th St., Chicago, Ill. Price $5.

A.S.T.M. STANDARDS 1941 SUPPLEMENT—√ Part I, Metals; Part II, Nonmetallic Materials—Constructional; Part III, Nonmetallic Materials—General. Copies of the supplements can be obtained from the A.S.T.M. Headquarters, 260 S. Broad St., Philadelphia, Pa., at $3 for any one part, $5 for any two parts, and $7 for all three parts. Also available, without cost to purchaser is the Index to the A.S.T.M. Standards, including Tentative Standards.

GURLEY MANUAL OF SURVEYING INSTRUMENTS—49th Edition. 208 pp. May be obtained from W. & L. E. Gurley, Troy, N. Y. Price 50c.

Reports and Pamphlets

SCHEDULE OF MINIMUM SURVEYING FEES—Ohio Society of Professional Engineers, 63 S. High St., Columbus, Ohio. Price 10c.

√CONDENSATION OF MOISTURE AND ITS RELATION TO BUILDING CONSTRUCTION AND OPERATION—Bulletin No. 18, Engineering Experiment Station, University of Minnesota, Minneapolis, Minn.

CHARLESTON, S. C.—Year Book 1939. Reports of officers and commissioners.

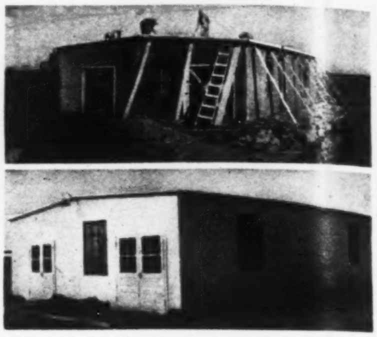
ANALYSES OF SKEW SLABS—Engineering Experiment Station, University of Illinois, Urbana, Ill. Price, $1.

ASPHALT PAVEMENTS' BENEFICIAL CONFINING EFFECT—A supplement to "Bomber Flying Fields," The Asphalt Institute, 801 Second Ave., New York.

√MILITARY ROADS IN FORWARD AREAS—Manual of Engineering Practice No. 23, American Society of Civil Engineers, 33 West 39th St., New York. Price, non-members, $1.40.

√SURVEYS OF HIGHWAY ENGINEERING POSITIONS AND SALARIES—Manual of Engineering Practice No. 24, American Society of Civil Engineers, 33 West 39th St., New York, Price, non-members, $1.30.

PUMPING STATION IN TEXAS



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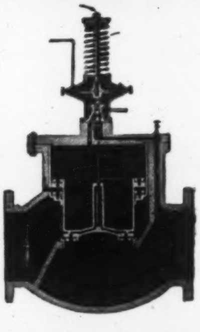

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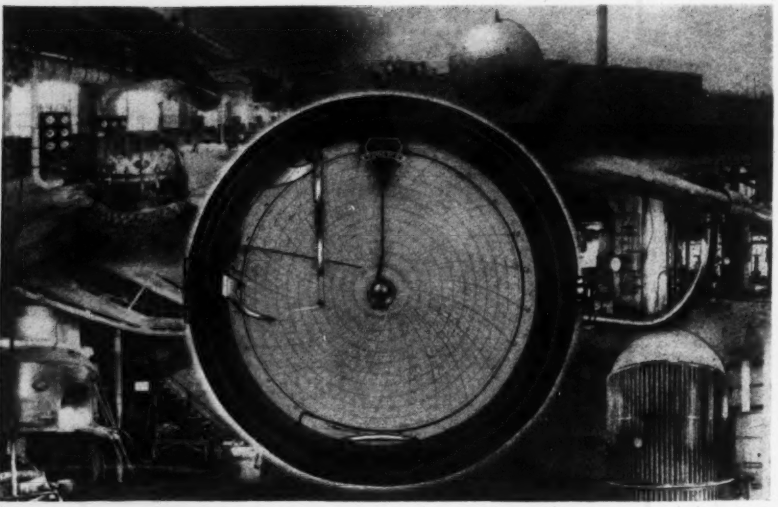

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MEETINGS

Annual Highway Engineering Conference, University of Utah, Salt Lake City, Utah, Feb. 2–6.

Associated General Contractors of America, 23rd annual convention, Claypool Hotel, Indianapolis, Ind., Feb. 16–18.

American Toll Bridge Association, annual meeting, Hotel Peabody, Memphis, Tenn., Feb. 16–18.

American Concrete Institute, 38th annual convention, Palmer House, Chicago, Ill., Feb. 17–19.

American Concrete Pipe Association, New Orleans, La., Feb. 23–24.

American Road Builders Association, Peabody Hotel, Memphis, Tenn., March 2–6.

American Railway Engineering Association, Palmer House, Chicago, March 17–19.

REGIONAL AND LOCAL MEETINGS

Texas Conference on Soil Mechanics, 5th annual meeting, University of Texas, Austin, Tex., Feb. 6–7.

Minnesota Federation of Architectural and Engineering Societies, annual meeting, Nicollet Hotel, Minneapolis, Minn., Feb. 11–14.

Ohio Society of Professional Engineers, annual meeting, Deshler-Wallick Hotel, Columbus, Ohio, Feb. 12–13.

New York State County Highway Superintendents Association, annual meeting, Albany, N. Y., Feb. 12.

Southeastern State Highway Officials, first annual meeting, Grove Park Inn Hotel, Asheville, N. C., Feb. 12–13.

Minnesota Surveyors & Engineers Society, annual convention, Minneapolis, Feb. 12–14.

Michigan Highway Conference, 28th annual meeting, University of Michigan, Ann Arbor, Mich., Feb. 18–20.

Southern Safety Conference, 4th annual meeting, Roosevelt Hotel, New Orleans, La., Feb. 22–24.

Association of Highway Officials of the North Atlantic States, Hotel Benjamin Franklin, Philadelphia, Pa., Feb. 25–27.

New Jersey Sewage Works Association, 27th annual meeting, Stacy-Trent Hotel, Trenton, N. J., Mar. 5–6.

N. J. Mosquito Extermination Association, 29th annual meeting, Atlantic City, N. J., March 11–13.

then I said to myself-

It's development—or envelopment

I thought this field trip was to preview tomorrow's world *of welding—but look what's happening* today.

ALTER EGO: It may be tomorrow to you but I'm afraid it's yesterday to these people. Here they've completely shield-arc welded a building in the shop—toted it to location on a shield-arc welded truck-trailer—dropped it to the foundation with a shield-arc welded tractor crane.

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And, as they say, "The result is a lighter, stronger product—be it machine, building, ship or what have you—a design that can be more easily and quickly changed for improvements." *No wonder they've kept their products away from any enveloping movement. Their flanks won't be blitzed in the Battle for Business a few years hence. So much for them—but* how *about* us—*how can we get similar results for our products?*

ALTER EGO: Wouldn't it be well for us to ask The Lincoln Electric Company, Cleveland, Ohio, for their Structural Design Studies to get practical pointers on change-over to welding?

ALTER EGO: Literally, "one's other self"—the still, small voice that questions, inspires and corrects our conscious action.

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1 **Union-Formed** (pre-formed) ropes resist unraveling and unlaying when cut.
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UNION Wire Ropes
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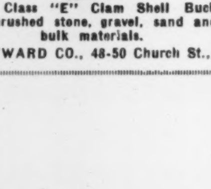
Hayward Buckets



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MEN AND JOBS

William C. Bowers of Milan, Ill., has resigned his position as structural designer with the Arundel Construction Corp. and Consolidated Engineering Co., Inc., to accept a commission in the U. S. Navy. He has received an appointment as assistant civil engineer with the rank of lieutenant in the Civil Engineering Corps of the Navy. For the past year and a half he has been engaged on work at the naval airbase in San Juan, Porto Rico, and other bases in the Caribbean.

William J. Cox, Connecticut State Highway Commissioner, has announced the following changes and additions to his staff: **Walter Jones** becomes supervisor of survey and construction at the new Danielson residency; **Daniel J. Linehan,** formerly in charge of the New Haven office, has been given special supervision of location in all sections of the state under direction of **John H. Smith,** engineer of location and design; **E. S. Lawler,** now at the Milford residency, is succeeding Mr. Linehan at New Haven; **Franklyn W. Disbrow** becomes acting resident engineer at New Milford to succeed Mr. Lawler; **D. Carl Loewe,** engineer of construction at Hartford, has been given supervision of the contracts section and will do field work for **M. A. Tyack,** department engineer of contracts and construction; **C. R. Trowbridge,** who has been taking care of engineering work in the southwestern part of the state, will shortly be placed in charge of a residency engineering post for that section.

Howard M. Turner and **Samuel M. Ellsworth,** consulting engineers, have removed their associated offices from 12 Pearl St. to 6 Beacon St., Boston, Mass. Mr. Turner was connected with the hydroelectric development of the Turners Falls Power & Electric Co. in the Connecticut Valley, and later went to Boston to engage in private practice, specializing in that field. Mr. Ellsworth specializes in sanitary engineering and both ngineers are lecturers at the Harvard Graduate School of Engineering, Cambridge.

Paul H. Cover, of Youngstown, Ohio, has been appointed part-time municipal planning engineer for Youngstown. Mr. Cover attended Ohio State University.

Maj. Frank W. Salfingere of the U. S. Engineers, who has been stationed at Charleston, W. Va., supervising construction at Kelly Field, has been transferred to Chillicothe, Ohio. **Lieut. John Dershimer** succeeds Major Salfingere at Charleston.

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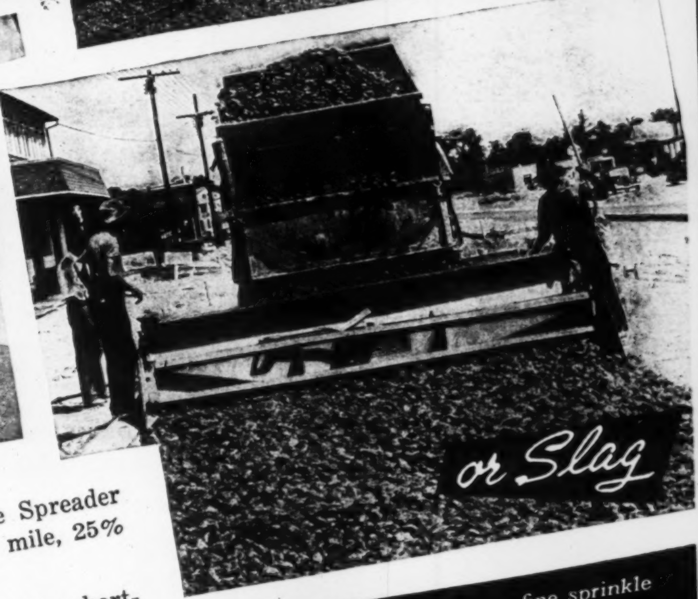

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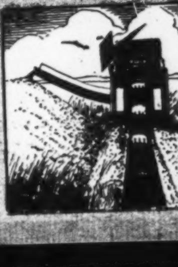

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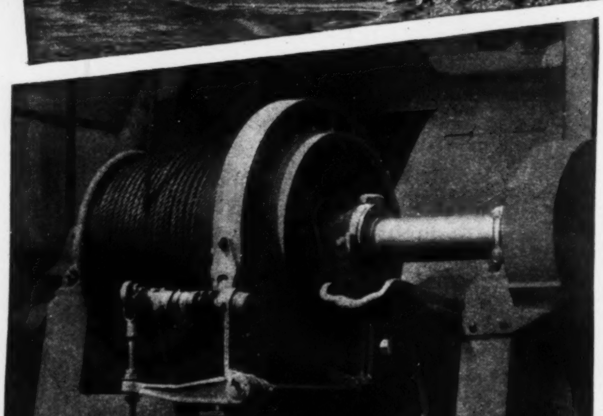

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Symbols and Abbreviations Include:

† Federal Government
★ Project of $500,000 or over
ENR Engineering News-Record
CD Engineering News-Record Construction Daily

Projects—By Size

Construction projects here reported cover the United States and Canada, are of these minimum sizes or larger: water supply, earthwork, waterworks, $15,000; other public works, $25,000; industrial buildings, $40,000; other buildings, $150,000.

Classes of Construction

(Named in order of Listing)

Water Supply
Sewers, Waste Disposal
Bridges, Grade Cross'gs
Streets & Roads
Earthwork, Waterways
Unclassified
Latin America
Public Buildings
Commercial Buildings
Industrial Buildings

Stages Reported

PROPOSED: (except Streets & Roads):

BIDS ASKED (new announcements only. For full calendar, see also preceding issues of ENR);

LOW BIDDERS: On jobs below $500,000 value all low bidder news will be the final reports published on the projects involved except where award is not made to the low bidder. In this case, a supplementary contract award report will be published.

CONTRACTS AWARDED: Except awards to low bidders previously reported in low bidder stage.

Dates shown are of issue in which last previous report was published.

WATER SUPPLY

PROPOSED WORK

Ala., Montgomery—City, water facilities. $86,000. **DPW.**

Calif., Ferndale—Surveys ordered auxiliary water supply, constructing proposed Francis Creek Dam. Over $25,000.

Ill., Toulon—$25,000 bond election Mar. 3. reservoir pond for WW sys.

Ia., Davenport—Exten. watermain sys. to Garden Addn., Harbor Rd. $15,000. J. H. Jebens, mayor.

Md., Baltimore—City and Baltimore Co., Towson, 36 in. watermain to Glen L. Martin Plant.

†Mass., Chicopee—City Water Dpt., 27 Tremont St., bids early in February, WW exten., 30 in. pipe line, Docket Mass 19-104. $320,531. **DPW.** Hayden, Hardin & Buchanan, 622 Park Sq. Bldg., Boston, engrs. CD 1/13—ENR 1/15.

Miss., Columbus—T. W. Harris, mayor, water supply line to Air Corps Training Base.

N. J., Newark—Water Dpt., City Hall Annex, 6- to 12-in. c.i. watermains, 6 and 7 Aves., $38,670. WPA. W. Banks, city engr.

N. C., Raleigh—G. Andrews, mayor, bond election soon, exten., reconstructing water supply sys. $130,000.

O., Cleveland—Watermain extens. Wagar, Clague, and Riverview Rds. Over $50,000. J. C. Wenrick, city engr.

O., North Fairfield—B. O. Maerkisch, mayor, WW sys., wells, distr. sys., etc. $63,000. Champe, Finkbeiner & Assoc., Nicholas Bldg., Toledo, engrs.

†Okla., Pryor—City, filters, exten. water distr. sys. $108,000. **DPW.** R. Collins, McAlester, engr. CD 12/2—ENR 12/4.

Pa., Seneca—Seneca Water Co., W. P. Ferringer, supt., plans purchasing, extend. facilities Pinoak Water Co. Over $15,000.

S. C., Myrtle Beach—WW sys. exten. Seeking DPW funds. $169,000. T. M. Jordan, Myrtle Beach, engr.

Tenn., Blountville—T. R. Bondy, judge Sullivan Co., water line from Bristol to here. $30,000. W. Gardner, Blountville, engr.

Tenn., Dyersburg—City, 3 m.g. filter plant. $150,000. Black & Veatch, 4706 Bway., Kansas City, Mo., engrs. CD 12/31—ENR 1/8.

Tex., Abilene—4 m.g. sand filters. Over $15,000. E. Yates, Abilene, engr.

Tex., Edinburg—A. A. Aldrich, mayor, bond issue voided, waterworks plant. $250,000. Project abandoned. CD 12/26—ENR 1/1.

Tex., Fort Worth—Tarrant Co. Water Control and Imprv. Dist. 3, c/o J. Meeker, pres., water and sewage control. J. J. Rady, Majestic Bldg., engr.

Wash., Renton—Water Dist. 62, water sys., suburban dist., near here. $27,775. Applied to DPW.

Wash., Longview—D. W. Carpenter, city clk., bids soon water filter plant. $80,000. J. W. Cunningham, Spalding Bldg., Portland, Ore., engr. CD 10/10—ENR 10/16.

Wash., Yakima — Replacing old watermains and exten. past city limits, etc. $429,349. A. B. Collins, City Hall, engr.

†Alaska, Kodiak — Regional DPW Office, Alaska Bldg., Seattle, Wash., bids soon headworks and water distr. sys., Docket 50-123. $77,000. **DPW.** Hubbell & Waller, Alaska Bldg., Seattle, Wash., engrs. CD 12/9—ENR 12/11.

Ont., Fort Erie—Bids soon WW sys., pump. plant $21,600, force main $38,850, filtration plant $44,300, mains, etc. Total est. $162,000.

Ont., Toronto—Water services, Civic Parks. $17,000. Parks Committee, City Hall, engr.

BIDS ASKED

Bids Asked February 2

†Conn., New London—City Manager, Municipal Bldg., water sys., 6,000 ft. 20 and 24 in. c.i. transits or concrete pipe, 30x60 ft. pump. station, 20x24 ft. gate house, steel standpipe, Docket Conn. 6-126. $349,986. **DPW.** Extended date. Clarence M. Blair, Inc., 100 Crown St., New Haven, engrs. CD 1/13—ENR 1/15.

Bids Asked February 5

O., Grover Hill—Village Bd. P. Affairs, S. Myers, mayor, WW sys. $40,000. Ellis & Wertz, Van Wert, engr. CD 10/27—ENR 1/30.

Tex., Houston—8 and 12 in. c.i. water mains. $85,000.

†Tex., Pelly—C. H. Olive, mayor, WW and sewer facilities, Tex. 41-261. $126,000. **DPW.** Garrett Eng. Co., 3504 Audubon St., Houston, engrs. CD 12/17—ENR 1/25.

Bids Asked February 6

†D. C., Wash.—Dpt. Interior, National Park Service, Interior Bldg., 18 and C Sts. N.W., pump. station, Washington Aqueduct in Rock Creek and Potomac Parkway, Sect. 3.

†N. C., Fayetteville — Pub. Wks. Comn., J. F. Burgess, chn., 95,070 lin. ft. 2- to 8-in. water distr. mains, etc., Docket N.C. 31-109. **DPW.** W. C. Olsen, 5 Exch. Pl., Raleigh, engrs. CD 10/6—ENR 10/9.

★**†Tex., Pasadena**—City, D. T. Atkinson, mayor, WW and sewerage sys. imprvs., Docket Tex. 41-246. $532,699. **DPW.** Garrett Eng. Co., 3504 Audubon St., Houston, engrs. CD 12/31—ENR 1/8.

Bids Asked February 11

Mass., Fall River—City, Water Works Dpt., City Hall, water sys., Contr. 1, pump. station, diesel engine and pump; Contr. 2, 42 in. pipe line, Lake Noquocke-Darmouth to Watuppa Pond, Docket Mass. 19-101. $410,365. Hayden, Harding & Bichanan, 622 Park Sq. Bldg., Boston, engrs. CD 1/2.

LOW BIDDERS

†Calif., San Luis Obispo—San Luis Obispo Water Dist., Jan. 20, reservoir, Docket Calif. 4-151, Unit 2, from Theo Main, 1424 Mill St. **$74,992. DPW.** CD 1/6.

Colo., Denver and **Littleton**—Bd. Water Comn., City and County Bldg., Denver, Jan. 15, replacement Conduit 2, 19,978 ft. pipe, South University Blvd., north of Belleview Ave. on Belleview and east of Littleton, from Lock Joint Pipe Co., 1716 California Bldg., Denver. **$207,771.** CD 1/9—ENR 12/4.

Ia., Council Bluffs—N. Hansen, city clk., Jan. 20, intake bldg., Contr. 5, for WW, from Jensen Constr. Co., 1527 12 St., Des Moines. **$98,850.** Est. $70,000. CD 12/30—ENR 1/8.

†S. C., Fort Jackson—Area engineer, Fort Jackson, Jan. 22, water supply and distr. sys. for new cantonment, from M. L. Gaines, Columbia. **$72,946.**

†S. C., Spartanburg—Pub. Wks. Comrs., 168 Main St., Columbia, Jan. 15, c.i. watermains, Docket S. C. 38-116, from Fiske-Carter Constr. Co., Spartanburg. **$75,657. DPW.** CD 11/24—ENR 11/27.

CONTRACTS AWARDED

N. Y., New York—Dpt. Water Supply, Gas & Electricity, Municipal Bldg., exten., imprv. water distr. sys. **WPA. $304,066.** W. W. Johnston, 70 Columbus Ave., dir. Div. Operations.

N. Y., St. George—Dpt. Water Supply, Gas & Electricity, Municipal Bldg., New York, exten. c.i. watermains, **WPA. $417,396.** W. W. Johnston, 70 Columbus Ave., dir. Div. Operations.

O., Canton—Stark Co. and City, exten. water and sanitary sewers to Toytown community, near here. **WPA. $430,866.** L. K. Zerbe, Canton, co. engr.

O., Cincinnati—Water service branches for Dept. Water, to Crumley, Jones & Crumley, Blue Ash Ave. and Hegner Dr. Park. **$289,610.** Est. $300,000. H. H. Kranz, city engr.

S. C., Charleston—St. Andrews Parish, St. Andrews St., WW. **WPA. $100,000.**

S. C., Spartanburg—Comr. P. Wks., 188 Main St., WW sys., to Fiske-Carter Constr. Co., Spartanburg. **$75,857.**

Tenn., Chattanooga—Hixson Utility Dist., James Bldg., WW, Hixson area. **WPA. $125,000.** E. Bass, mayor

SEWERS WASTE DISPOSAL

PROPOSED WORK

N. J., Newark—Sanitary sewers, sheating, Bridge St. $52,050. WPA. J. Costello, city engr.

N. J., Somerdale—Rein.-con. pump. station, sludge drying beds, force main, 127 manholes, etc. $52,907. WPA. G. R. Swinton, 930 Atlantic Ave., Atlantic City, WPA engr.

N. J., Westmont—Haddon Twp., Twp Hall, Westmont, c.i. and terra cotta sewer lines, gate valves, imprv. disposal plant, etc., Haddon Twp. $52,100. WPA. G. R. Swinton, 930 Atlantic Ave., Atlantic City, WPA engr.

N. C., Raleigh—G. Andrews, mayor, bond election soon, incinerator. $79,000.

†Okla., Pryor—City, vitr. clay tile sanitary sewerage sys. $112,000. **DPW.** R. Collins, McAlester, engr. CD 12/2—ENR 12/4 under WW.

Pa., Dale—Boro Council, exten., replacements, imprv. storm water sewerage sys. $30,000.

★**†Tex., Houston**—City, N. Pickett, mayor, sanitary sewers, disposal plant, $1,500,000. **DPW.** CD 8/11—ENR 8/14.

†Tex., Texas City—City, c/o C. Nessler, mayor, Unit 2, sanitary sewers, disposal works, Docket Tex. 41-107 (part). $41,000. **DPW.** J. J. Rady, Majestic Bldg., Fort Worth, engrs. CD 7/21—ENR 7/24.

Va., Richmond—Combined sewers, Hazelhurst, North and Fendall Aves. G. M. Bowers, dir. Dpt. P. Wks.

Wash., Bremerton—E. J. McCall, city clk., City Hall, 9,020 ft. 8- to 30-in. sewers, 32 manholes, 86 drains, etc., in New City Dist. $46,140. Berry & Casad, Elks Temple, engrs.

Wash., Bryn Mawr—King Co., County-City Bldg. Seattle, sewerage sys. Over $25,000. District to be formed. J. R. Heath, c/o owner, engr.

†Alaska, Kodiak—Regional DPW Office, Alaska Bldg., Seattle, Wash., bids soon sewerage sys., Docket 50-124. $86,400. **DPW.** Hubbell & Waller, Alaska Bldg., Seattle, Wash., engrs. CD 7/9—ENR 7/17.

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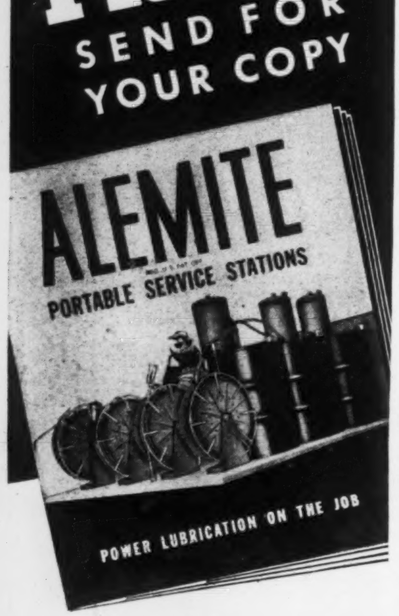

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BIDS ASKED

Bids Asked February 4

†Md., Hyattsville—Washington Suburban Sanitary Comn., Hamilton St., vitr., rein.-con. sewers, **DPW** Project Md., 18-150; adv. ENR 1/29.

Michigan—State Hy. Dpt., Lansing, sewer relocation, 4,755 ft. sewer, S.P. DA-W1-D1 of 81-20C-1 on U. S. 112 relocation· 5,385 ft. S.P. DA-W1-D1 of 81-20C-2 on Wiard Rd., east of Ypsilanti, both Washtenaw Co.

†Tex., Mineral Wells—City, sanitary sewer lines, Docket Tex. 41-158, $50,750. **DPW.** J. J. Rady, Majestic Bldg., Fort Worth and J. Montgomery, 918 Littlefield Bldg., Austin, engrs. CD 1/15—ENR 1/22.

Bids Asked February 5

†Conn., Bridgeport—City, Pub. Wks. Dpt., City Hall, sewers, sewage pump. station, etc., Evers Lane, Docket Conn 6-107. $35,000. **DPW.** Henry L. Rowland, city engr. J. A. Weimann, 3018 Main St., engr. H. K. Oatley, 26 Oakview Ave., Maplewood, N. J., consult. engr. CD 1/20—ENR 1/22.

Bids Asked February 6

†N. C., Fayetteville—Pub. Wks. Comn., J. F. Burgess, chn., 67,500 lin. ft 6- to 24-in. sanitary sewer lines, Docket N.C. 31-108. **DPW.** W. C. Olsen, 5 Exch. Pl., Raleigh, engr. CD 11/24—ENR 1/27.

†S. C., North Charleston—At office L. M. Marx, regional dir. Federal Works Agency, 22 Marietta St. Bldg., Atlanta, Ga., outfall sewer, pump, station, Docket S.C. 38-118, for North Charleston Pub. Service Dist. $45,200. **DPW.** Extended date. John McCrady Co., 9 State St., Charleston engrs. CD 1/23.

LOW BIDDERS

N. J., Long Branch—City, Jan. 19, from Thomas Proctor Co., Inc., 218 N. 5 St., sewage treatment plant, appurtenances **$200,456,** outfall sewer **$77,786,** interceptor sewer **$193,714.** CD 1/6—ENR 1/8.

†Tex., Beaumont—City, R. Edmonds, mgr., Jan. 15, incinerator, Docket Tex. 41-146, from Seymour Constr. Co., Beaumont. **$73,500.** Est. $70,000. **DPW.** H. E. Burns, 4139 Normandy St., Dallas, engr. CD 12/26—ENR 1/1.

CONTRACTS AWARDED

†Calif., Salinas—City, enlarging, imprv. sewage treatment plant, Docket Calif. 4-142, to S. Koller, 1694 Pomona St., Crockett. **$323,188. DPW.** CD 12/26—ENR 1/1.

Ia., Waterloo—R. B. Slippy, mayor, imprv. sewage disposal plant, hired labor. **$125,000.**

†Md., Towson—Baltimore County Comrs., 7,900 lin. ft. 20 in. force main from Essex Sewage Pumping Sta. across Back River to Baltimore City Outfall Sewer, Back River Sewage Treatment Plant, to Ligon & Ligon, 3310 Ridgewood Ave., Baltimore. Est. **$155,000.** Bids 1/5. CD 12/24—ENR 1/1.

N. J., Englewood—Rein.-con. sanitary sewer from pump. sta. along Cedar Lane, etc., **WPA. $49,101.** C. Malstrom, Orange and N. 6 Sts., Newark, WPA engr. CD 1/8—ENR 1/15.

N. Y., Brooklyn—President Brooklyn Boro, Boro Hall, replacing existing sewers, appurtenances, **WPA. $187,685.** W. W. Johnston, 70 Columbus Ave., New York, dir. Div. Operations.

★**N. Y., New York**—President Manhattan Boro, Municipal Bldg., replacing existing sewers with FTRC sewers, appurtenances, E. 79 St., **$643,278;** replacing with arch type rein.-con. sewers, various locations, **$106,272;** arch type rein.-con. sewers, Bleeker St., **$313,144, WPA.** Grand total $1,062,694. W. W. Johnston, 70 Columbus Ave., dir. Div. Operations.

Tex., San Antonio—Expanding sanitary sewerage sys. **WPA. $52,096.**

Va., Richmond—Sanitary sewers, Woodville Dist., near here, to McLean Constr. Co., Newport News, **$44,000.** G. M. Bowers, dir. Dpt. P. Wks.

BRIDGES GRADE CROSSINGS

PROPOSED WORK

Calif., Davenport—State Hy. Comn., Sacramento, completing plans 4 bridges, State Hy. (southern sector Coast Rd.) $89,500. C. H. Purcell, P. Wks. Bldg., Sacramento, state hy. engr.

N. Y., Falconer—Village Bd., steel, concrete viaduct and overpass, S. Work St. $307,000. S. T. Benson, village engr. R. L. Turner, Morgan Bldg., Buffalo, consult. engr.

N. Y., New York—Transit Comn., Metropolitan Div., Dpt. Pub. Serv., 270 Madison Ave., rejected bids Jan. 6, bridge, 233 St. CD 1/8—ENR 1/15, under LB.

O., Youngstown—Mahoning Co., reconstructing Spring Common Bridge. $55,000. R. J. Schomer, Youngstown, co. engr. CD 11/26—ENR 12/4.

Okla., Weatherford—State Hy. Dpt., Oklahoma City, made preliminary plans underpass under Rock Island Lines and U.S. 66,

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BRIDGES, etc. (Proposed Work, Cont'd.)

near here. $35,000. V. T. Moon, Capitol, Oklahoma City, engr.

Pa., Williamsport—City Council, R. R. Rall, dir. in charge, City Hall, Pennsylvania R.R. Co., W. B. Wood, ch. engr., Broad St. Sta., Phila., Pa., Reading Co., A. E. Owen, ch. engr., Reading Terminal, Phila., and Comrs. Lycoming Co., Court House, Williamsport, revised plans steel, concrete hy. bridge over Susquehanna River, Market St. $300,000. L. Mussina, city engr. CD 7/23—ENR 7/31.

BIDS ASKED

Bids Asked February 3

†Ark., Dyess—Farm Security Admin., Donaghey Bldg., Little Rock, treated timber bridges. Extended date. CD 12/16—ENR 12/18.

North Carolina—State Hy. & P. Wks. Comn., Raleigh, structures 1.54 mi. Co. Project. 469, Mecklenburg Co. $25,000-$50,000. W. V. Baise, Raleigh, engr.

†Virginia — Public Roads Admin., Winder Bldg., 17 and F Sts. N.W. Wash., D. C., Bridges 7 and 8, War Dpt. Bldg. road network, Arlington Co.; adv. ENR 1/29.

Bids Asked February 4

Michigan—State Hy. Dpt., Escanaba, T-Beam rein.-con. bridge over Black River, FB 3 of 6-5C-1 on M-95, Relocated, Marquette Co.; 3 span, rein.-con. bridge, S.P. SN-FB1 of 36-2-12C-1 on U. S. 2, Fortune Lake relocation, Iron Co.

Michigan—State Hy. Dpt., Lansing, 3 level rein.-con., steel grade separation SP. DA-W1-B3 of 81-20-8BC-1 on U. S. 112; rein.-con. grade separation, 3 spans, Ypsilanti Twp., S.P. DA-W1-B2 of 81-20-13 BC-1 Wiard Rd.; 3 level, rein.-con., steel, grade separation, S.P. DA-W1-B2 of 81-20-8BC-1, on U. S. 112; 3 span, rein.-con. grade separation, crossing entrance to south Parkway area, S.P. DA-W1-B1 of 81-20-13BC-1, all foregoing Washtenaw Co.; 3 span, rein.-con. grade separation, S.P. DA-W1-B1 of 82-21-8BC-1, Wayne Co.

Bids Asked February 10

Maryland—State Roads Comn., Baltimore, steel, concrete bridge over Back River, Eastern Ave., Contr. 333-2-446, FAP DA-W1-5B, Baltimore Co.

Bids Asked About February 21

Kan., Kansas City—Chicago, Rock Island & Pacific R.R., W. H. Willis, asst. ch. oper. Off., LaSalle St. Station, Chicago, Ill., Union Pacific R.R. Co., B. H. Prater, ch. engr., 1416 Dodge St., Omaha, Neb., and Kansas City Pub. Serv. Co., 728 Delaware St., Kansas City, Mo., reflooring 18 St. viaduct. $30,000. T. Schlup, city engr. Bids 1/6 rejected. CD 1/9—ENR 1/15, under LB.

LOW BIDDERS

†Md., Aberdeen Proving Ground—Commanding General, Aberdeen Proving Ground, Jan. 22, bridge, gunstockage, from George & Lynch, Newport Gap Pk., Wilmington, Del. **$37,900.** CD 1/13—ENR 1/15.

CONTRACTS AWARDED

★ **Ohio**—State Hy. Dpt., Columbus, grade crossing elimination, project with New York Central R.R., consisting 4 track steel girder underpass structure, roadside imprv., sects. Cuyahoga Heights and Cleveland, Cuyahoga Co., to Lombardo Bros. Const. Co., 1770 E. 11 St., Cleveland. **$1,344,680.** Est. $1,395,980. Bids 1/13. CD 1/21, under LB—ENR 1/8.

Rhode Island—Div. Purchases, at office F. A. Adams, state purch. agt., Providence, FAP 41-E, superstructure Bridge 275, approaches, Ashton Viaduct, and hy. Mendon Rd., Providence Co., to F. T. Wescott, 95 High St., North Attleboro, Mass. **$398,650.** Bids 12/10. CD 11/25—ENR 11/27.

Tenn., Tazewell — Claiborne Co., concrete, steel bridge over Powell River, Crosby Rd., to Joe C. Meigan Co., Tazewell. **$25,000.** Est. $30,000.

Que., St. Sauveur des Montagnes—A. Belanger, municipality clk., rein.-con. bridge over River Simon, to J. T. Lavasseur, 3161 Masson St., Montreal. Est. **$30,000.** Bids 12/31. CD 12/16—ENR 12/18.

STREETS AND ROADS

BIDS ASKED

Bids Asked February 3

Maryland—State Roads Comn., Baltimore, asphaltic concrete surfacing 1.348 mi. Contr. B 333-3-466 FAP DA -W1-5C, Baltimore Co.; Spec. C bituminous on concrete paving 1.44 mi. Contr. B-333-4-466 FAP No. 5-A W1-5E, Baltimore Co.

North Carolina—State Hy. & P. Wks. Comn., Raleigh, grading, structures, S.T.B.C. surfacing 5.63 mi. P. 267, Cumberland Co., $50,000-$75,000; grading, concrete paving 1.54 mi. Co. Project 469, Mecklenburg Co., $75,000-$100,000. W. V. Baise, Raleigh, engr.

Bids Asked February 4

Michigan—State Hy. Dpt., Lansing, grading, drainage structures, concrete paving 2.999 mi. S.P.-DA-W1-82-38C-3 on M-17, Wayne Co.; 1.441 mi. S. Projs. DA-WR-13-36C-2 and AW-FACH-13-36C-3; 1.831 mi. S.P. DA-WR-13-36C-4 on Fort Custer Dr.-Heliner Rd. to Upton, both Calhoun Co.

Bids Asked February 11

California—C. H. Purcell, engr. State Hy., Sacramento, grading, roadmix surfacing 1.3 mi. surfacing, Wilder, Little Baldwin and Coja Creeks, Santa Cruz Co.

Bids Asked

†Calif., Fort Ord—Area Engineer, Fort Ord, additional interior paving, ENG 6665-42-25.

Calif., San Mateo—Received no bids Jan. 19 imprv. streets in Laurel Gardens Laurel Hills and Laurel Square Subdivisions, R.I. 41-22, concrete curbs, walks, asphaltic concrete paving, vitr. sewers, sewage pump. sta., etc. $103,118. Will readvertise. CD 1/12 under sewers.

Minnesota—State Hy. Dpt., St. Paul, rescinded contracts imprv. 6.8 mi. S.P. 14-3-02 (Trunk Hy. 32-177) and 6.9 mi. S.P. 1410-02, TH 82-179. Bids 11/28. CD 12/9—ENR 12/11, under CA.

CONTRACTS AWARDED

★ **Fla., Jacksonville**—Duval Co., completing New Hogan Rd. from here to Jacksonville Beaches and Shoreline Hy. south to St. Augustine, **WPA. $510,689.** H. Colee, Jacksonville, co. engr.

Ia., Clarinda—Page Co., G. F. Mitchell, aud., imprv. 121 mi. roads, to Iowa Road Building Co., 1495 Keo Way, Des Moines. **$47,543.** Bids 1/9. CD 12/31.

Ia., Dubuque—Dubuque Co., Dubuque, road imprvs., **WPA. $300,000.** L. J. Schlitz, Dubuque, co. engr.

Ia., Harlan—Shelby Co., C. Brodersen, aud., road imprvs., **WPA. $71,830.** J. P. Camery, co. engr.

Ia., Pocahontas—Pocahontas Co., Pocahontas, imprv. roads, **WPA. $50,000.** A. L. Thornton, Pocahontas, co. engr.

Miss., Forest—H. E. Bishop, mayor, street imprvs., **WPA. $50,000.**

N. J., Newark—Street Dpt., City Hall, grading, paving 10 St. Yard, etc., **WPA. $55,000.** G. Andress, city engr.

N. J., Union City and **Jersey City**—Hudson Co., Court House, Jersey City, grading, penetration macadam on concrete surfacing Central Ave., **WPA. $50,500.** F. Radigan, Court House, Jersey City, co. engr.

N. Y., Brooklyn—President Brooklyn Boro, Boro Hall, repaving on concrete fdn., **WPA. $189,855.** W. W. Johnston, 70 Columbus Ave., New York, dir. Div. Operations.

N. Y., Woodhaven—President Queens Boro, 120-55 Queens Blvd., Kew Gardens, 2 in. asphaltic concrete on 7 in. concrete repaving Rockaway Blvd., **WPA. $87,580.** W. W. Johnston, 70 Columbus Ave., New York, dir. Div. Operations.

Ohio—State Hy. Dpt., Columbus, imprv. 1.677 mi. Lorain Co., to Ohio Eng. Co., 105 6 St., Lorain. **$36,753,** est. $37,400***0.875 mi. Seneca Co., to G. A. Trombley, 39 Vance St., Toledo, **$53,932,** est. $56,500. Bids 1/13. State Hy. Dpt., Columbus, received no bids Jan. 13, imprv. 0.74 mi. Wyandot Co., $13,500. CD 1/2—ENR 1/8.

Okla., Ada—Street imprvs., **WPA. $114,492.**

Pa., Scranton—Dpt. P. Wks., City Hall, B. J. Harding, dir. P. Wks., city-wide sidewalk repair, etc., own forces. **$25,000-$35,000.** F. K. Derby, city engr.

Tenn., Altamont—C. W. Smith, judge Grundy Co., military access road, **WPA. $300,000.**

Tenn., Fayetteville—A. E. Simms, judge Lincoln Co., access road, **WPA. $50,000.**

Tenn., Johnson City—H. Greene, mayor, repairing, imprv. streets, sidewalks, **WPA. $101,400.**

Tenn., Knoxville—G. L. Webb, city mgr., sidewalks, **WPA. $50,000.**

Tex., Brady—McCulloch Co., c/o Judge, grading, structures, sub-base 8.7 mi. Camp San Saba-Mason Co. line Rd., **WPA. $183,295.** Shingle & Scott, 918 Littlefield Bldg., Austin, engrs.

Tex., Groesbeck — Limestone Co., imprv. roads in rural dists., etc., **WPA. $58,710.**

Tex., San Antonio—Bexar Co., access road between Kelly Field Bombing Range and Hy. 90, **WPA. $66,290.**

Tex., Sweetwater—Imprv. streets, alleys, **WPA. $294,990.**

Ont., Billings Bridge—Gloucester Twp., c/o C. H. Guest, clk., road imprvs., day labor. **$42,000.**

Ont., London—Middlesex Co. Council, London, imprv. roads, day labor under supervision R. Smith, engr. County Bldgs. **$191,140.**

Ont., Ottawa—Carleton Co. Council, Ottawa, suburban roadwork for 1942, day labor. **$113,200 voted.** A. K. Hay, Carleton Ave., Ottawa, engr.

Que., Quebec City—Municipality, F. X. Chouinard, city clk., repairing pavements, day labor. **$75,000.** E. Hamel, City Hall, engr.

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EARTHWORK WATERWAYS

PROPOSED WORK

Montana—State Water Conservation Bd., Helena, dam, Big Creek Lake, Victor, $43,000; dam, Blodgett Creek, west of Hamilton, $387,884. F. E. Buck, c/o owner, engr.

BIDS ASKED

Bids Asked February 7

†Arkansas—U. S. Eng., Gay Bldg., 300 Bway., Little Rock, 87,000 cu.yd. levee embankment right bank Arkansas River, Cardens Bottom Levee Dist. 2, Yell Co., near Dardanelle, Inv. 777-42-59.

Bids Asked February 9

†Florida—U. S. Eng., Jacksonville, maintenance dredging section Intracoastal Waterway, Jacksonville to Miami between vicinity Sebastian and Miami (Ship Channel, Turning Basin); adv. ENR 1/29.

†Kansas—U. S. Eng., 416 Wright Bldg., Tulsa, Okla., 11,000 cu. yd. levee embankment, Neosho River and tributaries, Dutton Levee Dist. near Erie, Neosho Co.

Bids Asked February 10

Louisiana—Dpt. P. Wks., Baton Rouge, Grand Bend levee, Rapides Parish.

Bids Asked about February 15

★**†Tex., Denison**—U. S. Eng., Citizens Natl. Bank Bldg., rein.-con. spillway for Denison Dam. **$3,000,000-$4,000,000.** CD 10/21—ENR 10/23.

Bids Asked February 16

†California—Bureau Reclamation, Customhouse, Denver, Colo., high-pressure gate assembly for fish trap at Keswick Dam, Central Valley Project, Spec. 1607-D.

Bids Asked February 20

†Tex., Galveston—U. S. Eng., Galveston, repairing north jetty, Galveston Harbor; adv. ENR 1/29.

Bids Asked About June 1

†Colorado — Bureau Reclamation, Customhouse, Denver, Colo., outlet pipe for Jackson Gulch Dam, Mancos Project, Spec. 1592-D. No bids received Dec. 15. CD 11/25—ENR 11/27.

Bids Asked

†Calif., Camp Roberts—Area Engineer, Camp Roberts, erosion control for Infantry Artil. Replacement Center.

CONTRACTS AWARDED

†California—Bureau Reclamation, Customhouse, Denver, Colo., 3,000,000 lb. reinforcing steel for Central Valley Project, Inv. A-33,457-A-5, to Republic Steel Corp., Oliver Bldg., Pittsburgh, Pa. **$97,500.** Bids 12/10. CD 12/5.

★**†Md., Hyattsville**—Washington Suburban Sanitary Comn., H. R. Hull, ch. engr., Owens Ave., Brighton Dam on Patuxent River, force account. Est. **$1,000,000.** Ambursen Co., 295 Madison Ave., New York, N. Y., consult. engrs. CD 11/7—ENR 11/13.

†Miss., Mileston — Farm Security Admin., Donaghey Bldg., Little Rock, Ark., 25 mi. drainage ditches, to Perry Bros., Yazoo City. **$23,534.** Bids 1/16. CD 12/16—ENR 12/18.

★**†New York**—U. S. Eng., 120 Wall St., New York, dredging 2,750,000 cu.yd. from Jamaica Bay, grading, fill area and drainage ditches, Idlewild Airport, Queens Co., to Gahagan Constr. Corp., 147 Remsen St., Brooklyn. **$576,700.** Bids 1/5. CD 1/7—ENR 1/15.

★**†Tennessee**—U. S. Eng., 306 U. S. Courthouse, Nashville, Dale Hollow Dam, part Cumberland River Project, to Morrison-Knudsen Co., 319 Bway., Boise, Idaho, approx. **$14,000,000.**

UNCLASSIFIED

PROPOSED WORK

★**Arkansas** — POWER LINE — Arkansas Power & Light Co., Pine Bluff, 188 mi. power line from Norfork Dam to Hot Springs, for defense plant. $2,344,000.

★**Ark., Berryville** — RURAL ELECTRIC LINES — Carroll Electric Co-operative Corp., Berryville, P. F. Arnold, supt., exten. lines. $1,500,000.

Calif., Richmond—SHIPYARD—Permanente Shipbuilding Corp., Latham Square Bldg., Oakland, 5-way shipyard.

Conn., Bridgeport — ATHLETIC FIELDS, etc.—P. Wks. Dpt., athletic fields, recreation, Beardsley Park. $25,000. H. Rowland, city engr.

★**†Conn., Groton (br. New London)**—AIRPORT—State Airport Comn., Hartford, plans Trumbull Airport, four 2,400 x 4,000 ft. runways, grading, draining, etc. for CAA. $685,000.

†Fla., Bartow—AIRPORT IMPROVEMENTS—U. S. Eng., 240 U. S. Courthouse and Post Office, Jacksonville, bids soon clearing, grubbing, grading, draining, muck and sod landing strips, paving runways, airport.

†Fla., Camp Blanding—RIFLE RANGE—U. S. Eng., 240 U. S. Courthouse and Post Office, Jacksonville, bids soon rifle range, Camp Blanding reservation. $[illegible]8,000.

†Fla., Fort Pierce—AIRPORT IMPROVEMENTS—U. S. Eng., 240 U. S. Courthouse and Post Office, Jacksonville, bids soon clearing, grubbing, draining, muck and sod landing strips and paving runways, airport.

†Fla., Gainesville — AIRPORT IMPROVEMENTS—U. S. Eng., 240 U. S. Courthouse and Post Office, Jacksonville, bids soon clearing, grubbing, grading, draining, muck and sod landing strips, paving runways, airport.

†Fla., Jacksonville—AIRPORT IMPROVEMENTS—U. S. Eng., 240 U. S. Courthouse and Post Office, bids soon clearing, grubbing, grading, draining, muck and sod landing strips, paving runways, airport.

†Fla., Leesburg — AIRPORT IMPROVEMENTS—U. S. Eng., 240 U. S. Courthouse and Post Office, Jacksonville, bids soon, clearing, grubbing, grading, draining, muck and sod landing strips, paving runways, airport.

†Fla., Orlando — AIRPORT IMPROVEMENTS—U. S. Eng., 240 U. S. Courthouse and Post Office, Jacksonville, bids soon clearing, grubbing, grading, draining, muck and sod landing strips, paving runways, airport.

†Fla., Sanford — AIRPORT IMPROVEMENTS—U. S. Eng., 240 U. S. Courthouse and Post Office, Jacksonville, bids soon clearing, grubbing, grading, draining, muck and sod landing strips, paving runways, airport.

†Fla., Stuart—AIRPORT IMPROVEMENTS—U. S. Eng., 240 U. S. Courthouse and Post Office, Jacksonville, bids soon clearing, grubbing, grading, draining, muck and sod landing strips paving runways, airport.

†Fla., Winter Haven—AIRPORT IMPROVEMENTS—U. S. Eng., 240 U. S. Courthouse and Post Office, Jacksonville, bids soon clearing, grubbing, draining, muck and sod landing strips, paving runways, airport.

†Fla., Zephyrhills — AIRPORT IMPROVEMENTS—U. S. Eng., 240 U. S. Courthouse and Post Office, Jacksonville, bids soon, clearing, grubbing, grading, draining, muck and sod landing strips, paving runways, airport.

†Ga., Gainesville — AIRPORT IMPROVEMENTS—U. S. Eng., Post Office Bldg., Savannah, clearing, grubbing, grading, draining landing strips, building area, airport, No. [illegible]

†Ga., Thomasville — AIRPORT IMPROVEMENTS—U. S. Eng., 240 U. S. Courthouse and Post Office, Jacksonville Fla., bids soon clearing, grubbing, grading, draining, muck and sod landing strips, paving runways, airport.

†Idaho, Montpelier—RUNWAYS, etc.—Civil Aeronautics Auth., Boeing Field, Seattle, Wash., two 150x5,000 ft. surfaced runways with 50 ft. taxiways, lighting for airport. $405,950. Funds allocated.

Illinois — OIL PIPELINES — Texas Pipe Line Co., Salem, oil pipelines, etc., Jefferson, Hamilton, Marion and Clinton Counties. H. E. Witt, Salem, engr.

★**Md., Annapolis** — FERRY SLIPS—State Roads Comn., Baltimore, bids in February, 2 pile, timber ferry slips, approach bridges, rein.-con. bulkhead, twin stone breakwater 800 ft. long, Sandy Point. $1,000,000.

★**†Md., Baltimore**—PIERS, etc.—Bethlehem Ship Building Corp., Key Highway, bids in February, 3 piers for ship repairs, shop bldgs., dredging, pile driving. $2,000,000. Federal financing.

†Mass., Nantucket—AIRPORT—U. S. Eng., 819 Industrial Trust Bldg., Providence, R. I., bids soon airport, NW/SE and NE/SW landing strips 500 ft. wide, 4,000 ft. long, 10 ft. paved strips, etc. $275,000.

★**†Mass., Norwood**—AIRPORT—U. S. Eng., Park Sq. Bldg., Boston, bids soon airport, NW/SE and NE/SW landing strips 5,000 ft. long, 500 ft. wide, 150 ft. paved runway, etc. $566,000.

†Mont., Cutbank — RUNWAYS, etc. — Civil Aeronautics Auth., Boeing Field, Seattle, Wash., two 150x5,000 ft. surfaced runways, with 50 ft. taxiways, lighting for airport. $400,000. Funds allocated.

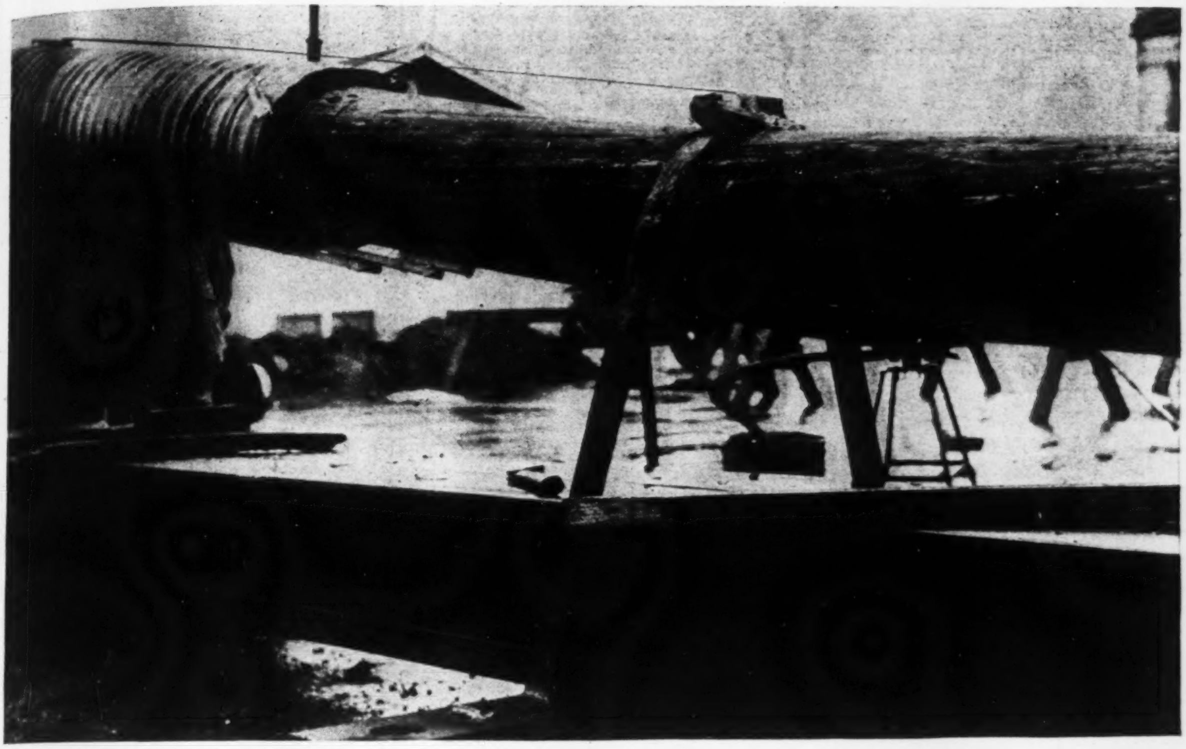
★**†Mont., Glasgow** — RUNWAYS, etc. — Civil Aeronautics Auth., Boeing Field, Seattle, Wash., two 150x5,000 ft. surfaced runways with 50 ft. taxiways, lighting for airport. $524,000. Funds allocated.

†Mont., Havre—RUNWAYS, etc.—Civil Aeronautics Auth., Boeing Field, Seattle, Wash., two 150x4,650 ft. surfaced runways with 50 ft. taxiways, lighting for airport. $400,000. Funds allocated.

★**Mont., Lasalle (mail Columbia Falls)**—AIRPORT—Flathead Co., Courthouse, Kalispell, airport, two 150x4,725 ft. surfaced runways, 50 ft. taxiways, lighting. $500,000. CAA. T. Judge, Courthouse, Kalispell, engr.

Neb., Grand Island—AIRPORT—F. S. White, city clk., airport imprvs., 2 runways, etc. $210,000 CAA allot.

†N. J., Hoboken—SHIP REPAIR PLANT—Tietjen & Lang Dry Dock Co., 1 Bway., New York, N. Y., brick, steel ship repair plant. Albert Kahn Associates, 345 New Center Bldg., Detroit, Mich., archts. and engrs. Defense Plant Corp. will finance. CD 11/14—ENR 11/20.



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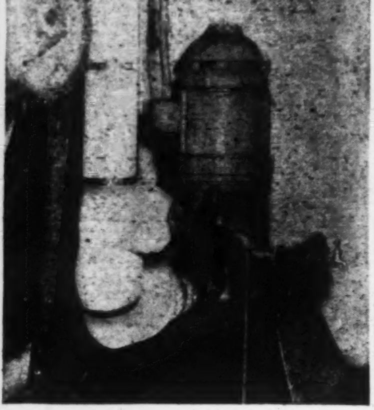

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UNCLASSIFIED (Proposed Work, Cont'd.)

N. J., Jersey City—GAS PUMPING MAIN—Pub. Serv. Electric & Gas Co., 80 Park Pl., Newark, 24 in. gas pump. main from West End Works to New Durham Holder Station. Over $25,000.

†N. Y., Dansville—AIRPORT—U. S. Eng., 960 Ellicott Sq. Bldg., Buffalo, bids soon exten. hard-surfaced runways, lighting, new bldgs., etc., municipal airport, for North Dansville Town Bd., Dansville. $186,000 allocated by War Dpt.

†Ore., Beaver—RUNWAYS—Civil Aeronautics Auth., Boeing Field, Seattle, Wash., two 150x5,250 ft. surfaced runways, 50 ft. taxiways, airport, Beaver Marsh, Tillamook Co. $200,000.

★**†Ore., Burns**—RUNWAYS—Civil Aeronautics Auth., Boeing Field, Seattle, Wash., two 150x5,200 ft. paved runways with 50 ft. taxiways for airport. $500,000 allotted.

★**†Ore., Corvallis**—RUNWAYS—Civil Aeronautics Auth., Boeing Field, Seattle, Wash., two 150x5,000 ft. paved runways, with 50 ft. taxiways, for airport. $503,000 allotted.

†Ore., Hillsboro—RUNWAYS—Civil Aeronautics Auth., Boeing Field, Seattle, Wash., two 150x4,050 ft. surfaced runways, 50 ft. taxiways, airport. $366,000 allotted.

Ore., Portland—FITTING DOCK, etc.—Commercial Iron Wks., 412 S. E. Stephens St., plans by S. B. Hayslip, Postal Bldg., 66x360 ft. fitting dock, ship yard, also 56x300 ft. shop, 20x40 ft. gatehouse, acetylene generator bldg. exten. Shipshed 2.

South Carolina—TRANSMISSION LINES—South Carolina Pub. Serv. Auth., at office C. H. Gerald, secy., 508 Peoples Office Bldg., Charleston, opened at Fort Sumter Hotel, Charleston, Sect. A, transmission lines, Santee-Cooper Project, Docket 4329-P-R, Berkeley, Orangeburg, Williamsburg, Georgetown, Horry and Richland Counties. $25,000. Harza Eng. Co., 27 Cumberland St., Charleston, engrs. CD 1/20—ENR 1/22.

★**S. C., Charleston** — DRYDOCK — Merrill-Stevens Dry Dock & Repair Co., J. A. Merrill, pres., 644 E. Bay St., Jacksonville, Fla., plans by Jacksonville Drydock & Constr. Mgmnt., Inc., Jacksonville, Fla., floating drydock. $900,000.

S. D., Yankton—AIRPORT—Voted $45,000 bonds, airport expansion. $100,000. CD 1/19—ENR 9/19.

Tex., Edinburg—NATURAL GAS SYSTEM—A. A. Aldrich, mayor, bond issue voided natural gas plant and distr. sys. $175,000. Project abandoned. CD 12/26—ENR 1/1.

★**†Tex., Houston**—SHIPBUILDING PLANT—San Jacinto Shipbuilders, Inc., 1710 Commerce St., bids soon, plant, on channel toward Galveston, for Maritime Comn., Wash., D. C. $3,285,000. CD 12/12—ENR 12/18.

Tex., Port Arthur—OIL STORAGE—Texas Co., 720 San Jacinto St., Houston, expanding underground oil storage facilities, here or points along Texas-La. coast.

★**Tex., Tyler**—SALT WATER INJECTION SYSTEM—East Texas Salt Water Disposal Corp., c/o L. E. Hardwicke, atty., Fair Bldg., Fort Worth, salt water injection program in oil fields, 39 disposal units, near here. $2,252,250.

Tex., Vernon—AIRPORT—City and Wilbarger Co., airport work. $270,000. CAA. Freese & Nichols, Capps Bldg., Fort Worth, consult. engrs.

★**†Washington** — TRANSMISSION LINE — Bonneville Power Admin., P. O. Box 3537, Portland, Ore., third 230,000 volt, double circuit steel tower line 185 mi. long, from Grand Coulee Dam to Covington, near Seattle. Construction authorized. $3,502,030 allocated to start work.

★**Wash., Seattle**—PIERS, etc.—Port of Seattle, Bell St. Terminal, 2 double piers, transit sheds, dredging, bulkhead, rein.-con. warehouse and office bldg., timber freight shed. $6,400,000. Seeking DPW funds. CD 12/18—ENR 12/25.

Wash., Shelton—FISH HATCHERY—State Game Dpt., Olympia, fish hatchery. $91,892.

Wis., Racine—WATER GAS GENERATING UNIT—Wisconsin Gas & Electric Co., Racine, water gas generating unit. $105,000.

Alta., Edmonton—PARKS, etc.—Parks and Gardens, 100 St. $100,000.

Man., Winnipeg—DAM—Reconstructing dam, Pointe du Bois power plant $30,000. Hydro Engineers, 55 Princess St., engr.

N. S., North Sydney—MARINE RAILWAY—Syndicate, c/o Councillor A. V. Forbes, Town Hall, marine railway. $50,000.

Ont., Fort Erie—DOCK—Buffalo & Fort Erie Ferry Co. Ltd., Fort Erie, reconstructing dock. $30,000.

Ont., Goderich — AERODROME, etc. — Secy. Dpt. Transport, Ottawa, bids soon relief aerodrome, clearing, grading, drainage, hard-surfaced runways, Sky Harbour, near here. $175,000.

Ont., Pembroke — BROADCASTING STATION—Ottawa Valley Brooadcasting Co. Ltd., c/o C. J. Jones, Noranda, Que., broadcasting station. $50,000.

Ont., Toronto—SAFETY ISLANDS—Pedestrian safety islands. $40,000. T. D. LeMay, City Hall, engr.

Que., Forestville—WHARF—[illegible]-Canadian Pulp & Paper Mills, Ltd., 71 [illegible] Peter St., Quebec City, wharf. $100,000.

Que., Montreal—SHIPYARD—United Shipyards, Ltd., c/o W. P. Creagh, [illegible] Caledonia Rd., shipyard. $50,000.

BIDS ASKED

Bids Asked February [illegible]

Maryland — LIGHTING SYSTEM — State Roads Comn., Baltimore, protective lighting sys. along entire north and south sides Susquehanna River bridge, Contr. H-322-9-47, Harford and Cecil Counties.

Bids Asked February [illegible]

†S. C., Aiken—AIRPORT—U. S. Eng., 33 Customhouse, Charleston, improv. airport $300,000. CAA. CD 8/5—ENR [illegible]7.

Bids Asked February 9

†Mich., Oscoda — AIRPORT IMPROVEMENTS—U. S. Eng., 613 Federal Bldg., Detroit, soil cement runway, taxiway and apron pavements, tie down anchors, Camp Skeel; adv. ENR 1/29.

Bids Asked February 11

†California — OVERHEAD TROLLEY — Bureau Reclamation, Customhouse, Denver, [illegible]-ton motor-operated, overhead trolley, Shasta Dam, Cantral Valley Project, Spec. 1605-D.

Bids Asked February 17

†N. Y., New York—DOCK REPAIRS—Pub. Bldgs. Admin., 7 and D Sts. S.W., Wash., D. C., dock repairs, Barge Office, South Ferry

Bids Asked February 20

†Utah, Provo—AIRPORT—U. S. Eng., 751 S. Figueroa St., Los Angeles, Calif., clearing grading, paving Provo Airport. CAA. Over $25,000.

Bids Asked

★**†N. Y., Syracuse**—BOMBARDMENT BASE—U. S. Eng., Security Mutual Life Insurance Bldg., Binghamton, bombardment base. $7,500,000. Bids accepted on unit-price basis. **(Correction**—address of owner.) CD 1/14—ENR 1/22.

Tex., Kerrville—AIRPORT—U. S. Eng., Federal Bldg., Galveston, clearing, grading, grubbing, etc., paving runways, taxiways, near here, for City and Kerr Co. $299,000. CAA. CD 6/26—ENR 7/10.

LOW BIDDERS

†Calif., Needles — AIRPORT IMPROVEMENTS—Civil Aeronautics Auth., 1500 4 St., Santa Monica, Jan. 19, 160,000 cu. yd. grading, 170,000 sq. yd. asphaltic concrete paving No. 138, from Gibbons & Reed, 259 W. 3 So. St., Salt Lake City, Utah, **$226,082**. CD 1/[illegible]

†Fla., Fort Lauderdale—RUNWAYS—U. S. Eng., 240 U. S. Courthouse and Post Office, Jacksonville, Jan. 17, runways, Inv. 436-42-243, from N. H. Latham & E. H. Latham, Jr., Guaranty Bldg., West Palm Beach, Alt. Spec. 1, **$241,607*****from J. D. Mauley, Leesburg, Alt. Spec. 2, **$242,437*****from Troup Bros., Macon, Alt. Spec. 3, **$233,324**. CD 1/13

†Ga., Moultrie—GAS FUELING SYSTEM, etc.—U. S. Eng., 240 U. S. Courthouse & Post Office, Jacksonville, Jan. 7, gas fueling sys., Inv. 436-42-215, also gas storage bldgs., Inv. 436-42-231, from Ivy H. Smith, 1525 San Maroc Blvd., **$114,000** and **$116,000** respectively. CD 12/31.

†La., Hammond—AIRPORT—U. S. Eng., foot Prytania St., New Orleans, Jan. 19, clearing, grubbing, draining site, grading, paving runways, taxiways, etc., near here, Tangipahoa Co., from R. B. Tyler Co., 1446 Levering St., Louisville, Ky. **$399,208**. CD 1/13.

†S. C., Walterboro—AIRPORT—U. S. Eng., 33 Customhouse, Charleston, Jan. 21, airport for Civil Aeronautics Admin., from Southern Constr. Co., Barnwell. **$244,172**. CD 1/15.

†Tex., San Antonio—AIRPLANE REPAIR BUILDINGS—U. S. Eng., U. S. P. O., Customhouse and Courthouse, 25 St. and Ave F, Galveston, structural steel, miscellaneous iron and reinforcing steel for airplane repair bldg. addn., Duncan Field, from Austin Bros., 1815 Combs St., Dallas **(1) $98,700**, (2) **$81,000**. Bids soon for construction bldg. Total est. $460,000. CD 1/6.

†Tex., Temple—AIRPORT—Civil Aeronautics Auth., c/o L. C. Elliott, regional dir., Fort Worth, Jan. 22, airport imprvs., clearing, grading, draining, widening and exten. runways, etc., from Bell & Braden, Herring Hotel Bldg., Amarillo. **$319,324**. CD 1/20.

†Tex., Vernon—AIRPORT—Civil Aeronautics Auth., c/o L. C. Elliott, regional dir., Fort Worth, airport imprvs., clearing, grubbing, grading, draining, paving N/S and NE/SW runways, 150x300 ft., 50 ft. taxiways, etc., from Uvalde Constr. Co., Santa Fe Bldg., Dallas. **$339,407**. Bids 1/20.

†Va., Blackstone—AIRPORT IMPROVEMENTS — Regional Manager, Civil Aeronautics Admin., La Guardia Field, North Beach, N. Y. Jan. 20, airport imprvs., grad-

UNCLASSIFIED (Low Bidders, Cont'd.)

ing, clearing, draining, from Albert Bros. Contractors, Inc., Box 208, Salem, **$112,027;** paving, from F. D. Cline, Fairview Rd., Raleigh, N. C., **$143,671.**

†Va., Petersburg—AIRPORT—U. S. Eng., 415 Post Office and Courthouse, Norfolk, Jan. 14, paved runways, clearing, grading, draining, etc., municipal airport, for CAA, from R. B. Tyler Co., 1446 Levering St., Louisville, Ky. **$418,591;** lighting, from Winn Electrical Co., 1197 River Ave., New York, N. Y., $33,397.

†Alaska, Whittier — TERMINAL PIER — U. S. Eng., Central Bldg., Seattle, Wash., Jan. 21, terminal pier for Alaska R.R., from Munter & Anderson, 1810 Bigelow Ave. N., Seattle, Wash. **$393,990.** CD 1/6—ENR 1/8.

CONTRACTS AWARDED

Conn., New Haven—COOLING TOWER—Winchester Repeating Arms Co., 275 Winchester Ave., 60 ft. high cooling tower, 25x145 ft. fdn., 14 in. concrete columns, etc. Owner builds.

★**Fla., Jacksonville** — DRYDOCK — Merrill-Stevens Dry Dock & Repair Co., J. A. Merrill, pres., 644 E. Bay St., 12,000 ton drydock on site between Marsh and Water Sts., to Geo D. Auchter Co., foot E. Adams St. **$1,300,000.** Crandall Dry Dock Engineers, Jacksonville, archts.

Fla., St. Augustine—HANGARS, etc.—Rebuilding hangars, grade and drainage work, new operations bldg., St. Augustine municipal airport, **WPA. $101,467.**

†Ga., Waycross—AIRPORT—U. S. Eng., Post Office Bldg., Savannah, additional work, CAA Airport, to M. C. Caddell, 2014 Dennis St., Jacksonville, Fla., **$192,252.** CD 11/12—ENR 1/20.

Ill., Decatur — PARK IMPROVEMENTS — Imprv. parks, Decatur Park Dist. **WPA. $178,466.**

Ill., East St. Louis—SWIMMING POOL, etc.—East St. Louis Park Dist., E. Griffing, supt., 929 Missouri Ave., swimming pool, clubhouse, shower and locker room facilities, imprvs., Lake Park, **WPA. $476,712.**

Kentucky—RURAL ELECTRIC LINES—South Kentucky Electric Corp., F. D. Gregory, supt., Somerset, 333 mi. rural electric lines, to W. A. Smith Constr. Co., Heyburn Bldg., Louisville, **$385,738.** CD 10/10—ENR 10/16.

†Miss., Jackson—AIR BASE BUILDINGS—U. S. Eng., U. S. Post Office & Courthouse, Vicksburg, additional bldgs., Jackson Air Base, to Werner Co., Inc., 1320 Pierre Ave., Shreveport, La. **$58,046.** Est. $60,000.

Miss., Laurel — RUNWAY — J. C. Miller, mayor, 3,500 ft. north and south runway. **WPA. $75,000.**

N. J., Camden—PARK IMPROVEMENTS—Camden Co. Park Comn., Court House, Camden, imprv. parks, **WPA. $58,100.** G. R. Swinton, 930 Atlantic Ave., Atlantic City, WPA engr.

★**†N. M., Roswell**—FLYING FIELD—U. S. Eng., Caddoa, Colo., flying field, grading, draining, runways, U. S. Army Airport, to Nolan Bros., Inc., and C. A. Wagner Constr. Co., 742 Metropolitan Bank Bldg., Minneapolis, Minn. **$1,234,941.** Est. $1,500,000. Bids 1/12, awarded 1/13. CD 12/30.

†N. M., Roswell—HANGAR—U. S. Eng., Caddoa, Colo., 100x200 ft. A. C. Hangar with 2 story lean-to, to K. L. House, 214 E. Marquette St., Albuquerque. **$131,568.** CD 12/30.

N. Y., Brooklyn—POLICE TRAFFIC SIGNAL CONDUIT—Police Dpt., 125 Center St., New York, installing underground conduit and post fdns. for police traffic signals. **WPA. $73,144.** W. W. Johnston, 70 Columbus Ave., New York, dir. Div. Operations.

N. Y., Kew Gardens—PLAYGROUND, etc.—Dpt. Parks, Arsenal Bldg., Central Park, 5 Ave. 64 St., New York, playground and comfort station, 137 St. and 76-77 Aves., **WPA. $169,550.** W. W. Johnston, 70 Columbus Ave., New York, dir. Div. Operations.

N. Y., New York — BOAT HOUSE — Dpt. Parks, Arsenal Bldg., Central Park, 5 Ave. and 64 St., boat house. **WPA. $97,143.** W. W. Johnston, 70 Columbus Ave., dir. Div. Operations.

N. Y., North Beach—RUNWAYS, etc.—Dpt. Docks, Pier A, North River, New York, connecting runways between land plane apron, Runways 2 and 4 and road, Marine Terminal, La Guardia Airport, **$75,000;** regrading, resurfacing runways, La Guardia Airport, **88,790. WPA.** W. W. Johnston, 70 Columbus Ave., New York, dir. Div. Operations.

N. Y., Ridgewood (sta. Brooklyn)—PARK IMPROVEMENTS — Dpt. Parks, Arsenal Bldg., Central Park, 64 St. and 5 Ave., New York, walk, paving, drainage, Highland Park, **WPA. $59,873.** W. W. Johnston, 70 Columbus Ave., New York, dir. Div. Operations.

N. D., Valley City—AIRPORT IMPROVEMENTS—L. T. Halvorson, city aud., airport imprvs., runways, grading, etc. **WPA. $75,000.** P. W. Barnes, city engr. CD 1/30—ENR 11/7.

Ore., Portland—SHIPYARD MESS HALL—Oregon Shipbuilding Corp., St. Johns Station, Portland, 60x200 ft. mess hall, shipyard, to Wegman & Son, Bd. Trade Bldg. Est. **$100,000.**

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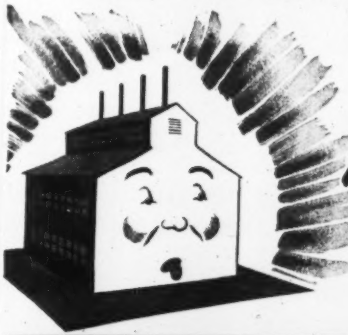

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UNCLASSIFIED (Contract Awarded, Cont'd.)

Pennsylvania — GAS DEVELOPMENT — Manufacturers Light & Heat Co., Union Trust Bldg., Pittsburgh, developing natural gas area, drilling deep wells, etc., near Waynesburg and Oak Forest, separate contracts and own forces. **$50,000-$60,000.** CD 1/14—ENR 1/22.

Pennsylvania — CABLE LINES — Bell Telephone Co. of Pennsylvania, 1835 Arch St., Phila., cable lines between Farmers Valley and Rew City, own forces. **$25,000.** CD 1/12—ENR 1/15.

Pennsylvania—NATURAL GAS DEVELOPMENT—United Natural Gas Co., United Natural Bldg., Oil City, developing natural gas reserves, properties, network pipelines, etc., own forces; drilling deep wells, separate contracts. Over **$50,000.** CD 1/9—ENR 1/15.

†S. C., Charleston—AIRPORT IMPROVEMENTS—City, imprv. Charleston Airport, repaving, constructing runway and protection for planes, for War Dpt. **WPA. $405,000.**

Tenn., Jackson—STREET LIGHTING SYSTEM—A. B. Faust, mayor, street lighting sys., day labor. **$25,000.**

Tex., Corsicana—AIR TRAINING SCHOOL—Air Activities of Texas, Corsicana, expanding facilitiese, runway work, etc., Primary Flight Training School, force account. **$75,000.**

†Tex., San Antonio—BOMBING RANGE—U. S. Eng., U. S. P. O., Customhouse and Courthouse, 25 St and Ave. F, Galveston, Puff Bombing Range (exterior distr. sys.), Brooks Field, to Graham & Collins Electric Co., 700 Ave. A., San Antonio, **$29,549.** Est. $43,103. CD 10/17—ENR 10/23.

†Tex., San Antonio—ARSENAL IMPROVEMENTS—War Dpt., 20 St. and Constitution Ave., N.W., Wash., D. C., additional arsenal imprvs., grading, roads, storm and sanitary sewers, reconstructing railway line. **WPA. $141,286.**

★**†Tex., San Antonio** — HANGARS — U. S. Eng., Fort Sam Houston, steel hangars, Schedules 302, 303 and 304, Kelly Field, to C. L. Browning, Jr., Builders Exch. Bldg., San Antonio, **$566,467.** Bids 1/20. CD 1/23.

Wash., Bellingham—AIRPORT—Whatcom Co. Court House, surfacing runways, airport, **WPA. $75,000.** W. A. Costello, Court House, engr. CD 1/2—ENR 1/8.

Wash., Olympia — CLEARING, etc. — City, clearing, grading, surfacing, airport, **WPA. $113,247.** C. H. Williams, City Hall, engr.

★**†Wash., Vancouver** — SHIPYARD—Kaiser Shipbuilding Corp., c/o Oregon Shipbuilding Corp., St. Johns Station, Portland, Ore., 8-way shipyard, outfitting dock, for maritime Comn., to Gilpin Constr. Co., Henry Bldg., Portland, Ore. Est. **$12,000,000.** CD 1/23.

W. Va., Maidsville—LOADING DOCK—Monongahela Rail & River Coal Corp., Fairmont, coal, loading dock, appurtenances, left bank Monongahela, near here, separate contracts and own forces. Over **$25,000.** CD 1/12—ENR 1/15.

Man., Carberry — HANGAR — Dominion Govt., Ottawa, Ont., hangar, No. 33 Service Flying Training School, to Claydon Co. Ltd., 290 Garry St., Winnipeg. Est **$60,000.** CD 12/29—ENR 1/1.

Ont., London—ROADBED—Canadian Pacific R. R., T. B. Ballantyne distr. engr., Ontario Dist., Union Sta., Toronto, reconstructing roadbed, day labor $140,000.

Sask., Maple Creek—TRAINING DEPOT—Secy. Dpt. Munitions & Supply, Ottawa, Ont., various bldgs., Militia Training Centre, to Bennett & White Const. Co. Ltd., 302 Examinor Bldg., Calgary, Alta, **$341,037.** CD 12/3—ENR 12/11.

LATIN AMERICA

South America, Venezuela, Caracas—Workers Bank agency of Venezuelan Government, plans twenty 4 story apartment bldgs., El Silencio section. $6,700,000. United States Export-Import Bank, 910 17 Ave. N.W., Wash., D. C., U.S.A., will finance.

PUBLIC BUILDINGS

PROPOSED WORK

†Ala., Mobile—School Comrs. Mobile Co. plans by Platt Roberts, Mobile, school, Docket Ala. 1-146. $216,000. **DPW.** CD 12/17—ENR 12/25.

†Ala., Prichard—Bd. Educ. plans by Harry Inge Johnstone, 60 St. Francis St., Mobile, school, Docket Ala. 1-178. **DPW.**

†Ala., Sylacauga—City, hospital facilities. $296,000. **DPW.**

★**†Ark., El Dorado**—War Dpt., 20 St. and Constitution Ave. N.W., Wash., D. C., making fdn. tests plant. Est. incl. equip. $23,000,000. Lion Oil Refining Co. will operate. Defense Plant Corp. will finance. CD 10/14—ENR 10/16

Ark., Malvern—City School Bd., A. B. Wetherington, supt. Schools, Malvern, school. $190,737. Seeking federal aid.

Calif., Woodland—Woodland High School Dist., $509,000 bond election Feb. 7, earthquake-proofing school bldgs.

Conn., Greenwich—J. G. Tobi[illegible] supt. Schools, Field Point Rd., will not con[illegible]uct, 2 story bsmnt., 60x60 ft. Havemeyer School, brick steel. $150,000. Project abandoned. CD 11/27.

★**Conn., Greenwich**—Town, [illegible]pt. Schools, rejected bids July 28, brick, steel Julian Curtiss School. $600,000. CD [illegible]—ENR [illegible] under LB.

★**†Conn., Hartford**—Defense Housing Div., FWA, 2082 Kings Highway, Fairfield, 200 frame defense housing units. $[illegible]50,000. Site not selected.

Conn., Plainville—Supt. Schools, 74 East St., sketches by Provoost & Everett, 121 Main St., Stamford, 2 story, bsmnt., brick, steel school addn. $150,000.

†Conn., Stratford—Town, W. H. Shea, mgr., Town Hall, bids soon 1 story, 4[illegible]x174 ft. high school addn., Docket Conn. 6-136. $39,611. **DPW.** Charles Wellington Walker, 1115 Main St., Bridgeport, archts. CD 1/9—ENR 1/15.

†D. C., Wash.—Pub. Bldgs. Admin., 7 and D Sts. S.W., Office Bldgs. I, J, K and L for Navy Dpt., south Lincoln Memorial Reflecting Pool; Office Bldgs. O and P, 4, 5, G and H Sts. N.W.; Office Bldgs. X and Y, East Capitol and 19 Sts. N.W.; Office Bldg. Z, Alabama Ave and Naylor St. S.E. (Anacostia); cafeteria and shop bldgs., 7 and Independence Ave. S.W.

★**Fla., Miami**—C. H. Reeder, mayor, City Hall and Dade Co., Miami, plans by Paist & Steward, Ingraham Bldg., and J. and C. Skinner, 1500 Alton Rd., Miami Beach, and C. F. Neergaard, 41 E. 42 St., New York, N. Y., assoc. archt., 5 story, bsmnt. hospital, nurses' home. $1,050,000.

†Ga., Camp Stewart—U. S. Eng., Post Office Bldg., Savannah, several bldgs., utilities, for 3 coast artillery regiments (anti-aircraft).

†Ill., Belleville—Div. Defense Housing, FWA, 811 Vermont Ave. N.W., Wash., D. C., 75 unit permanent housing.

†Ill., East St. Louis—East Side Health Dist., c/o Dr. R. C. Farrier, dir., 325 E. Bway., bids soon 2 story, bsmnt., 131x185 ft. U shaped health center bldg., Davision Ave. between 7 and 8 Sts. $300,000. **DPW.** Johnson, Maack & Saunders, Murphy Bldg., archts. CD 12/22—ENR 12/25.

†Ill., Granite City—Div. Defense Housing, FWA, 811 Vermont Ave., N.W., Wash., D. C., 3,000 demountable houses, Madison Ave. between 23 and 24 Sts., etc.

Ind., Fort Wayne—Power substation, southwestern part city. $50,000 or more with equip.

Kan., Johnson County (RFD Kansas City)—Johnson County Bd. Educ., Olathe, plans by Neville & Sharp, Midland Bldg., Kansas City, Mo., and Hardy & Schmacher, Scarritt Arcade Bldg., Kansas City, Mo., Westwood View School. $180,000.

†Ky., Fort Knox—War Dpt., acting by and through Lt. Col. C. D. Holmes, M. C., plans by E. T. Hutchings, Heyburn Bldg., Louisville, school, Docket Ky. 15-124. $259,145. **DPW.** CD 12/3—ENR 12/11.

†La., Camp Polk—Pub. Bldgs. Admin., 7 and D Sts. S. W., Wash., D. C., rejected bids Dec. 11, garage, flagpole, etc., Defense Housing Project. CD 12/9—ENR 12/12.

†Md., Fort George G. Meade—U. S. Eng., Fort George G. Meade, bids in February, cantonment bldgs., 2 story frame, concrete fdns.

Mass., Chicopee—Dpt. Schools, 135 Grape St., brick, steel school, Chicomansett Village. $150,000.

†Mass., Lowell—U. S. Eng., Park Sq. Bldg., 31 St. James Ave., Boston, sketches converting old post office into recreation center. $43,000.

†Mo., Robertson—McDonnell Aircraft Corp., Lambert-St. Louis Municipal Airport, 1 story plant for War Dpt. Withdrawn from market. CD 1/2.

Neb., Bellevue — School Dist. 1, D. E. Prather, secy., plans by J. L. Conley, 617 S. 51 Ave., Omaha, brick high and grade school addn. $160,000. Applied to DPW.

N. Y., Cassadaga—Bd. Supervs. Chautauqua Co., Court House, Mayville, at Hotel Jamestown Bldg., Jamestown, tuberculosis sanitorium addn. $150,000 with equip. Beck & Tinkham, Bailey Bldg., Jamestown, archts. CD 11/18—ENR 11/27.

N. Y., Tuckahoe—Tuckahoe Housing Auth., Village Hall, indefinitely postponed 58 unit housing, Project NY-8-1. USHA. CD 1/13—ENR 1/15.

N. C., Raleigh—G. Andrews, mayor, bond election soon, 2 fire stations, equip. $162,000.

Okla., Tulsa—Recreational center. $150,000.

†Ore., Hermiston—School Dist. 14, plans by C. B. Miller, P. O. Box 544, Pendleton, altering school, Docket Ore. 35-102. $8,360. **DPW.** CD 10/10—ENR 10/16.

†Ore., Hermiston—Union High School Dist. U-9, plans by C. B. Miller, P. O. Box 544, Pendleton, altering high school, Docket Ore. 35-101. $19,888. **DPW.** CD 11/13—ENR 11/20.

†Ore., Pendleton—Umatilla Co., health center, Docket Ore. 35142. $30,000. **DPW** increased gr. from $15,000 to $27,000. C. B. Miller, Pendleton, archt. CD 21/31—ENR 1/8.

★**Pa., Johnstown** — Johnstown Housing Auth., W. H. Burkhard, exec. dir., bids in March. Prospect low-rent housing. Project

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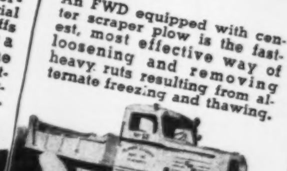

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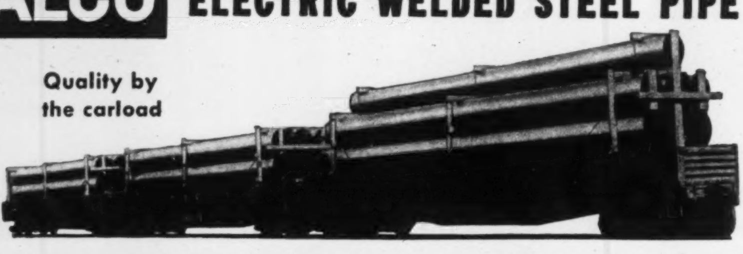

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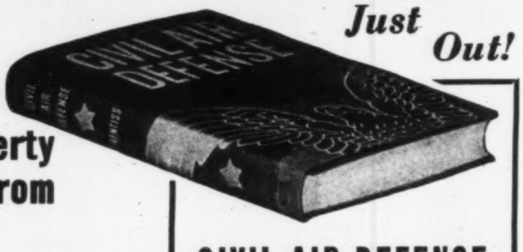

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PUBLIC BLDGS. (Proposed Work, Cont'd.)

Pa. 19-1. $500,000. USHA. H. A. Bailey, 105-6 Medea Bldg., archt. C. P. Brosch, New Brighton, consult. archt. H. [illegible] Lenz, c/o owner, engr. CD 9/2—ENR 9/[illegible]

S. C., North Charleston—North Charleston Pub. Serv. Dist. Comn., plans by Samuel Hannaford & Sons, Dixie Terminal Bldg., Cincinnati, O., and Simons & Lapham, 7 State St., Charleston, brick hospital, Rhett Ave. $171,200. Applied to DPW.

Tenn., Jackson—A. Wilde, judge Madison Co., Jackson, plans by Hart, Freeland & Roberts, 3 Natl. Bank Bldg., Nashville, high school. $150,000.

Tenn., Maryville—Blount County School Bd., W. A. McTeer, chn. Bd., Maryville, 2 schools. $300,000.

★**†Tenn., Memphis**—U. S. Eng., P. O. Box 97, West Memphis, Ark., Army Base Hospital, 120 acre tract, near here, Shelby Co. $10,000,000-$12,000,000.

†Tex., Beaumont—Pub. Bldgs. Admin., 7 and D Sts. S.W., Wash., D. C., 100 demountable houses. $225,000.

†Tex., Belton — City plans by Wyatt C. Hedrick, Inc., 1005 1st Natl. Bank Bldg., Fort Worth, recreation center. $100,000. **DPW.**

†Tex., Brownwood—Brownwood Ind. School Dist., plans by Voelcker & Dixon, 913½ Indiana Ave., Wichita Falls, Junior School $175,559, school $227,441. **DPW.**

★**†Tex., Dallas**—Magnolia Petroleum Co., Magnolia Bldg., plant, vicinity here. $15,000,000. Defense Plant Corp. will finance.

★**Tex., Edinburg**—A. A. Aldrich, mayor, bond issue voided, electric power plant and distr. sys. $500,000. Project abandoned. CD 12/26—ENR 1/1.

★**†Tex., Houston** — City, fire substations $450,000; exten., imprv. electric fire alarm sys., $350,000. **DPW.** CD 7/24—ENR 7/31.

†Tex., Legion—Veterans Admin., Vermont Ave. between H and I Sts., Wash., D. C., imprv., expanding facilities, hospital plant. $150,000.

†Tex., Mineral Wells—Bd. Educ. bids soon 1 and 2 story high school, Docket Tex. 41-401. $245,000. **DPW.** Bond issue voted. P. M. Geren, 806½ Burnet St., Fort Worth, archt. CD 12/30—ENR 1/1.

†Tex., Mineral Wells—Bd. Educ. bids soon brick, stone, concrete high school, $253,070 **DPW** funds allotted; school, $120,900 **DPW** funds allotted, Tex. 41-111. Bond issues voted on both projects. P. M. Geren, 806½ Burnet St., Fort Worth, archt. CD 11/7—ENR 11/13.

★**†Tex., Nederland** — Pure Oil Co., 35 E. Wacker Dr., Chicago, Ill., 100-octane gasoline refinery, near here. $3,000,000. Defense Plant Corp. will finance. CD 12/29—ENR 1/1.

★**†Tex., Orange**—Federal Works Agency, 18 and F Sts. N.W., Wash., D. C., 300 demountable houses, utilities, etc. $550,000.

†Tex., Orange—Pub. Bldgs. Admin., 7 and D Sts. S.W., D. C., 100 demountable houses. $225,000.

†Tex., Port Arthur—Pub. Bldgs. Admin., 7 and D Sts. S.W., Wash., D. C., 100 demountable houses. $225,000.

†Tex., San Angelo—Pub. Bldgs. Admin., 7 and D Sts. S.W., Wash., D. C., rejected bids Dec. 23, management and maintenance garage, Defense Housing Project, Air Corps Basic Training School. CD 12/4—ENR 12/11.

★**†Tex., Texarkana**—Federal Works Agency, 18 and F Sts. N.W., Wash., D. C., 500 demountable type houses. $1,300,000 allotted.

★**†Tex., Texas City**—Southport Petroleum Co., Kilgore, 100-octane aviation gasoline refining plant. $4,000,000. Defense Plant Corp will finance. CD 12/29—ENR 1/1.

†Va., Arlington—Pub. Bldgs. Admin., 7 and D Sts. S.W., Wash., D. C., rejected bids Dec. 23, management and maintenance bldg., Defense Housing Project. CD 12/4—ENR 12/11.

†Wash., Bremerton — Bremerton Housing Auth., bids soon 2 fire stations, Docket Wash. 45-125. $100,000. **DPW.** F. A. Naramore & Associates, Dexter Horton Bldg., Seattle, archts. CD 11/6—ENR 11/13.

†Wash., Des Moines—Union High School Dist. R, revised plans by W. Mallis, Lyon Bldg., Seattle, high school addn., Docket 45-107. $400,000. **DPW.** CD 12/16—ENR 12/18.

★**†Wash., Silverdale**—Federal Works Agency, 18 and F Sts. N.W., Wash., D. C., 425 demountable housing units, Kitsap Co. $2,272,500.

Wash., Seattle—School Bd., S. E. Fleming, acting school supt., 810 Dexter Ave., high school, Juneau St. and 42 Ave. S., high school, West Seattle, school, Othello St. and Beacon Ave. Over $150,000. DPW funds sought.

†Wash., Tacoma—Clover Park School Dist. 400, Pierce Co., schools, school addns., Docket Wash. 45-130. $300,000. **DPW.** CD 12/10—ENR 12/18.

†Wash., Walla Walla — Bonneville Power Admin., P. O. Box 3537, Portland, Ore., power substation addn. $130,000. Funds allocated.

Wash., Yakima—Yakima Valley Junior College, Yakima, plans by J. W. Maloney, Larson Bldg., college. $175,000.

Alta., Edmonton—Plans by C. S. Burgess, City Hall, civic auditorium, 100 St. $350,000.

Man., Brandon—Dominion Govt., Ottawa, Ont., plans by Dpt. National Defense, Ottawa, Ont., barracks, etc., for Canadian Women's Army Corps. $150,000.

PUBLIC BLDGS. (Proposed Work, Cont'd.)

N. S., New Glasgow—Wartime Housing, Ltd., 55 York St., Toronto, Ont., prefabricated dwellings. $200,000.

★**N. S., New Glasgow** — Aberdeen Hospital Trust, c/o J. Saunders, pres., hospital addn. $500,000. Applied to N. S. Legislature for permission to borrow funds.

★**Ontario**—Dominion Govt., Ottawa, Ont., synthetic rubber plant. $500,000. Location withheld. Dpt. Munition Supply, Ottawa, engrs.

Ont., Lindsay—Secy. Dpt. Munitions & Supply, Ottawa, bids soon arsenal addn. $150,000.

Sask., Regina—Dominion Govt., Ottawa, Ont., addnl. accommodations, No. 12 Basic Army Training Centre. $150,000. Dpt. National Defense, Ottawa, Ont., archts. Dpt. Munitions & Supply, Ottawa, Ont., engrs.

BIDS ASKED

Bids Asked February 2

Ont., Ottawa—Maroni & Morris, archts., 46 Bloor St. W., Toronto, 2 story, bsmnt., 100x300 ft., rein.-con., brick office bldg., King Edward Ave. for Bank of Canada. $400,000. CD 1/5—ENR 1/8.

Bids Asked February 3

†**Ark., Jonesboro**—Farm Security Admin., Donaghey Bldg., Little Rock, farmstead units.

†**La., Columbia**—Farm Security Admin., Donaghey Bldg., Little Rock, Ark., farmstead units.

Bids Asked February 4

†**Ark., Batesville**—Farm Security Admin., Donaghey Bldg., Little Rock, farmstead units.

†**Conn., Bantam**—Defense Housing Div., FWA, 2082 Kings Highway, Fairfield, 40 defense housing units, Docket Conn. 6083X. $140,000. D. Sanford, High Ridge Rd., Stamford, archt. CD 11/3—ENR 11/6.

†**La., Oak Grove**—Farm Security Admin., Donaghey Bldg., Little Rock, Ark., farmstead units.

Bids Asked February 5

†**Pa., Pulaski**—Beaver County Housing Auth., Monaca, 100 defense housing units, Pulaski Twp., for USHA, Project Pa.-36055-X. Extended date. CD 1/16—ENR 1/22.

†**Conn., Fairfield**—Bd. Educ., Reef Rd., 2 story, bsmnt., brick, steel Roger Ludlow High School addn., Docket Conn. 6-115. $124,380. DPW. O. C. S. Ziroli, 1330 Post Rd., archt. CD 1/12—ENR 1/15.

Bids Asked February 6

†**Ala., Dothan**—U. S. Eng., 409 U. S. Courthouse & Customhouse, Mobile, A.C. Base engine shop. CD 11/26—ENR 12/4.

†**Fla., Key West**—Key West Housing Auth., 210 defense housing units for USHA, Project Fla.-8073. CD 11/25—ENR 11/27.

†**Ind., Columbus**—U. S. Eng., P. O. Box 59, Louisville, Ky., Triangular Division Cantonment, bldgs., roads, drainage, grading, sewers, water and gas distr., etc., near here; adv. ENR 1/29. CD 1/20—ENR 1/22.

†**N. Y., Niagara Falls**—Niagara Falls Housing Auth., 450 defense housing units for USHA, Project NY-30071.

Bids Asked February 7

Pa., Monaca—Beaver County Housing Auth., 104 unit housing, Project Pa-14-1, and 50 unit Project Pa-14-2, USHA. Extended date. CD 1/13—ENR 1/15.

†**Wash., Longview** — Bonneville Power Admin., P. O. Box 3537, Portland, Ore., metal-clad switchgear for new substation, Inv. 2543.

Bids Asked February 9

†**Md., Towson**—Bendix Radio Div., Bendix Aviation Corp., Bendix, N. J., steel, brick, factory addn., concrete fdns. $300,000. H. E. Beyster Corp., General Motors Bldg., Detroit, Mich., engrs. Defense Plant Corp. will finance.

†**N. C., Durham**—U. S. Eng., 308 Customhouse, Wilmington, Triangular Division Camp, Inv. 982-42-98. William A. Piatt, Durham, and W. S. Lee Eng. Corp., 422 S. Church St., Charlotte, engrs. CD 8/5—ENR 8/7.

★†**Okla., Braggs**—U. S. Eng., 416 Wright Bldg., Tulsa, 1,731 frame bldgs., water, sewers, gas and electrical sys., roads, grading, draining, etc., near here, Muskogee Co. Extended date. Over $20,000,000. CD 1/16—ENR 1/22.

★†**Ore., Medford**—U. S. Eng., 628 Pittock Blk., S.W. 10 Ave. and Washington St., Portland, 1900-bldg. cantonment. Tentative date. $20,000,000. M. Hunt & H. C. Chambers, 408 S. Spring St., Los Angeles, Calif., archts. Blackie & Wood, Alaska Commercial Bldg., San Francisco, engrs. CD 5/28—ENR 6/5.

Ore., Salem—State Bd. Control, Salem, 2 story, rein.-con. medical center and receiving unit, State Hospital. $325,000. Tentative date. A. E. Doyle & Associate, Pacific Bldg., Portland, engrs. CD 1/21.

P. R. Mayaguez—Municipal Housing Auth. of Mayaguez, 337 housing units, Project PR 4-2, USHA. Extended date. CD 1/13—ENR 1/15.

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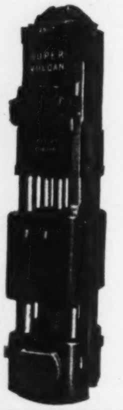

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PUBLIC BLDGS (Bids Asked, Cont'd.)

P. R., Ponce—Municipal Housing Auth. of Ponce, 150 housing units, Project PR 1-7. USHA. Extended date. CD 1/13—ENR 1/15.

Bids Asked February 10

Ark., Conway—Conway Housing Auth., 30 unit housing, Project Ark-6-1 and 20 unit housing, Project Ark-6-2. USHA. Extended date. CD 1/13—ENR 1/15.

†Ark., Paragould—Farm Security Admin., Donaghey Bldg., Little Rock, farmstead units.

★**†Colo., Colorado Springs**—U. S. Eng., 1709 Jackson St., Omaha, Neb., cantonment. CD 1/15—ENR 1/22.

Pa., Pittsburgh—Pittsburgh Housing Auth., Dr. B. J. Hovde, dir., Terrace Village, grading, sewer, water and gas lines for Arlington Housing, Project Pa. 1-4. A. M. Marks, Wm. B. Simboli and R. S. Fisher, 702 Grogan Bldg., archts. CD 8/7—ENR 8/14, under LB.

†Tex., Wichita Falls—U. S. Eng., Citizens Bank Bldg., Denison, laundry, boiler house, etc., Shephard Field.

Bids Asked February 11

Pa., Monaca—Beaver Co. Housing Auth., Monaca, 72 unit housing, Project Pa-14-5. USHA. Extended date. CD 1/13—ENR 1/15.

Tenn., Nashville—Nashville Housing Auth., G. Gimre, exec. dir., 212 Warner Bldg., administration-service bldg. for James A. Cayce Homes, Proj. Tenn. 5-1 and 5-1-A. Marr & Holman, Stahlman Bldg., archts.

Bids Asked February 12

†Idaho—Bureau Reclamation, Customhouse, Denver, Colo., office bldg., Anderson Ranch Dam, Boise Project, near Mountain Home, Spec. 1604-D.

†Pa., Aliquippa — Beaver County Housing Auth., R. Bennet, chn., Court House, Beaver, 50 defense housing units, for USHA, Project Pa-36058-X. Extended date. CD 1/16.

Bids Asked February 13

Pa., Greensburg — Westmoreland County Housing Auth., Greensburg, 150 unit housing, Project Pa-18-2. USHA. Extended date. CD 1/13—ENR 1/15.

†Washington—Bureau Reclamation, Customhouse, Denver, Colo., telephone terminal equip. for Grand Coulee Power Plant, Columbia Basin Project, Spec. 1606-D.

Bids Asked February 16

★**Ark., Fort Smith**—Fort Smith Housing Auth., 176 unit housing, Project Ark-3-1 and 150 unit housing, Project Ark-3-2. USHA. Extended date. CD 1/13—ENR 1/15.

Bids Asked February 17

★**Mass., Holyoke**—Holyoke Housing Auth., 56 Suffolk St., 220 unit housing, Project Mass-5-2. **$1,142,000.** USHA. CD 1/19—ENR 1/22.

†N. Y., Montauk—Pub. Wks. Officer, 3rd Naval Dist., 90 Church St., New York, barracks, outlying bldgs., wharf, Spec. 10795.

Tex., Denton—Texas State College for Women, Denton, power plant engine room, turbogenerator unit, etc. Over **$40,000.**

Tex., Sanatorium—State Bd. Control, Austin, power plant engine room, 200 kw. turbogenerator unit, etc., for State Tuberculosis Sanatorium.

Bids Asked About February 20

†N. M., Roswell—U. S. Eng., Caddoa, Colo., temporary bldgs., Roswell Airfield.

†Pa., Titusville—Bd. Educ., Titusville School Dist., high school addn., **Docket Pa.** 36-115. **$70,500. DPW.** Tentative date. Beck & Tinkhan, Bailey Bldg., **Jamestown, N. Y.,** archts. CD 12/17—ENR 12/25.

Bids Asked February 21

†La., Baton Rouge—Baton Rouge Housing Auth., 40 defense housing units for USHA, Project La-16051. CD 12/15—ENR 12/18.

Bids Asked February 23

Ky., Owensboro—Owensboro Municipal Housing Auth., 124 unit housing, Project Ky-9-1, and 50 unit housing, Project Ky-9-2. USHA. Extended date. CD 11/28—ENR 11/27.

★**N. Y., West New Brighton (sta. Staten Island)**—New York City Housing Auth., 122 E. 42 St., New York, 388 unit Edwin Markham housing, Project NY 5-9. USHA. Tentative date. CD 12/11—ENR 12/18.

Bids Asked February 24

Pa., Slater—P. Rood, city clk., power plant, equip., distr. sys. **$65,000.** R. W. Gearhart, 349 21 St. S.E., **Cedar Rapids,** engr. CD 12/15—ENR 12/18.

Bids Asked

†Fla., Mac Dill Field—U. S. Eng., 240 U. S. Courthouse and Post Office, **Jacksonville,** headquarters and admin. bldg.

†Ga., Valdosta—U. S. Eng., 240 U. S. Courthouse and Post Office, **Jacksonville,** radio transmitter bldg., electric service connection, service road, Advanced Twin Engine School.

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PUBLIC BLDGS. (Bids Asked, Cont'd.)

†Ga., Moultrie—U. S. Eng., 240 U. S. Courthouse and Post Office Bldg., Jacksonville, Fla., radio transmitter bldg., service road etc., Advanced Single Engine School.

LOW BIDDERS

Calif., Burbank—City Manager, City Hall, Jan. 20, rein.-con., steel structure, municipal steam power plant, from H. F. Hendrickson Co., 2811 Clearwater St., Los Angeles. **$61,220.** Est. $100,000. CD 1/6—ENR 1/8.

★**†Calif., Los Angeles**—Div. Defense Housing FWA c/o Los Angeles Housing Auth., 1031 S. Bway., Jan. 22, 400 housing units, Project 4104, Vermont Ave., 253 St. and Pacific Coast Hy., in city of Los Angeles near Lomita, from W. C. Crowell, 495 S. Arroyo Parkway, Pasadena, **$997,000;** site development, from Theo A. Beyer Corp., 533 Chamber Commerce Bldg., Los Angeles, **$196,479.** CD 1/14.

★**Calif., San Francisco**—San Francisco City and County Housing Auth., 525 Market St., Jan. 20, 136 unit housing, Project Cal. 1-8, from Carrico & Gautier, 365 Ocean Ave. **$599,-389.** Est. $400,000. USHA. CD 1/16—ENR 12/25.

†Calif., Vallejo—Pub. Bldgs. Admin., 7 and D Sts. S.W., Wash., D. C., Jan. 22, Bay Terrace School 2, for Vallejo Unified School Dist., from Robert McCarthy, 1363 14 Ave., San Francisco. **$295,498.** **DPW.** CD 11/24—ENR 11/27.

★**†Calif., Wilmington**—Div. Defense Housing FWA c/o Los Angeles Housing Auth., 1031 S. Bway., Jan. 23, 384 housing units, Project 4103, Wilmington, C. F. and Hawaiian Sts., from Myers Bros., 3407 San Ferando Rd., Los Angeles, **$897,414;** site development, from W. W. Petley, 1426 LaBrea Ave., Los Angeles, **$144,079.** CD 1/14.

Colo., Denver—Denver Housing Auth., W. Hedgcock, exec. secy., City and County Bldg., Jan. 13, general contract 76 dwelling unit, etc. housing, Proj. Colo. 1-4, 25 and Arapahoe Sts., from A. C. Larsen, 2648 Josephine St., **$189,552;** plumbing, heating, from Denver Plumbing & Heating Co., 1810 Blake St., **$62,750.** CD 12/26—ENR 1/1.

★**†D. C., Wash.**—Federal Security Agency, 4 and Independence Ave. S.W., Jan. 20, additional bldgs., St. Elizabeth Hospital, Nichols Ave., beyond Anacostia, from M. Shapiro & Sons Constr. Co., Inc., 254 W. 54 St., New York, N. Y., **$854,000.** CD 12/19—ENR 12/25.

★**Ill., Springfield** — Memorial Hospital of Springfield, 5 St. and N. Grand Ave. E., Jan. 12, 8 story hospital, Miller and 1 Sts., from W. H. Franklin Co., 101 N. 5 St., and John Felmley Co., 1302 E. Reynolds St. **$1,-289,000.** Est. $1,225,000. CD 12/24—ENR 1/1.

†O., Fairfield—Farm Security Admin., The Mall between 12 and 14 St. S.W., Wash., D. C., 100 residences, administration bldg., Hy. 4 between Hubbel Ave. and Xenia Pike, from Hagerman Constr. Co., 402 E. Superior St., Fort Wayne, Ind. **$322,458.**

★**Pa., Duquesne**—Allegheny County Housing Auth., F. L. Palmer, exec. dir., 301 County Office Bldg., Pittsburgh, Jan. 23 general contract Burns Heights Housing Development, 27 residential apt. bldgs., 182 units, Project Pa. 6-4, from Maurice Schumacher, 438 Baker Bldg., and Madsen Const. Co., 1790 Lyndale Ave., Minneapolis, Minn., Base Bid 1, **$597,500,** Base Bid 1-A, **$575,900*****plumbing, from W. N. Sauer Co., 2701 East St., NS, Pittsburgh, **$87,400** ***sewer, gas and water lines, from Nardulli & Sons Co., Inc., 937 Butler St., Pittsburgh, **$29,800*****comb. plumbing, sewers, gas and water lines, from Wm. N. Sauer Co., 2701 East St., Pittsburgh, **$110,400*****heating, from Pittsburgh Heating & Piping Co., Starr Bldg., Pittsburgh, **$56,453*****electrical work, from Hale Electric Co., 6218 Penn Ave., Pittsburgh, **$31,299.** CD 1/6—ENR 1/8.

★**R. I., Woonsocket**—Woonsocket Housing Auth., 285 Main St., Jan. 23, 300 unit 2 story, brick, row housing units, Project RI-3-1, Morin Heights, from Chain Constr. Corp., 210 Main St., Pawtucket, and 135 E. 63 St., New York, N. Y. **$1,159,000,** Alt. 1 deduct **$21,000** Alt. 2 deduct **$50,000.** Est. $1,100,000. CD 1/20—ENR 1/15.

★**†S. C., Fort Jackson**—Area Engineer, Fort Jackson, Jan. 16, cantonment of tents, from M. B. Kahn Constr. Co., 714 Lady St., Columbia. **$755,000.**

†Tex., Pasadena—Pasadena Housing Auth., H. A. Paine, chn., 777 bldgs., approx. 154 units, Project 41032, Tarter, 10 and 11 Sts., for USHA, from Pittman Bros., 2800 N. Galvez St., New Orleans, La. **$452,413.** CD 1/16.

★**†Va. Blackstone**—U. S. Eng., 415 Post Office & Customhouse, Norfolk, Jan. 20, cantonment, from V. P. Loftis, Builders Bldg., Charlotte, N. C. **$25,751,938.** CD 1/13—ENR 1/15.

★**†Washington**—Bureau Reclamation, Customhouse, Denver, Colo., Jan. 15, 3 generators for Units L-7, L-8 and L-9, Grand Coulee Power Plant, Columbia River Basin Project, Spec. 1018, from Westinghouse Electric Co., East Pittsburgh, Pa. **$2,792,330.** CD 1/6—ENR 1/8.

†Wash., McChord Field—U. S. Eng., 700 Central Bldg., 800 3 Ave., Seattle, Jan. 16, plant (product unknown), from C. F. Davidson, 2906 S. 9 St., Tacoma. **$334,056.** CD 12/30.

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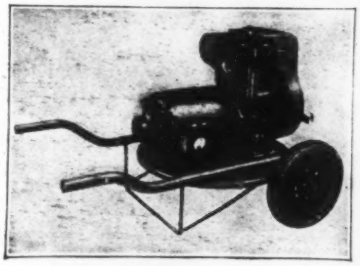

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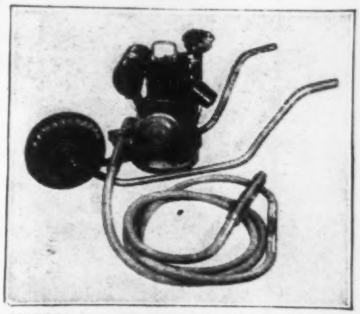

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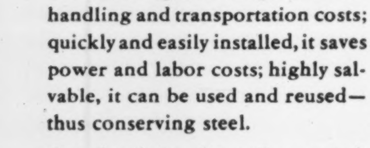

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PUBLIC BLDGS. (Low Bidders, Cont'd.)

★**†Wash., Poulsbo**—Defense Housing Div., FWA, 811 Vermont Ave. N.W., Wash., D. C., Jan. 20, 300 housing units, 1 and 2 story frame bldgs., from Macri, Mullen & Strand, 1222 8 Ave. W., Seattle. **$930,000.** CD 1/16.

CONTRACTS AWARDED

†Alabama — Farm Security Admin., Bell Bldg., Montgomery, farmstead units, Lowndes Co., to Bear Lumber Co., 400 Lee St., Montgomery. **$206,987.**

★**†Ala., Gadsden**—Republic Steel Corp., Republic Bldg., Cleveland, O., coke ovens, to Semet-Solvay Co., 40 Rector St., New York, N. Y. Est. **$2,000,000.** Defense Plant Corp. will finance.

★**†Ala., Ozark**—U. S. Eng., 409 U. S. Courthouse and Customhouse, Mobile, anti-aircraft training camp, to J. A. Jones Constr. Co., 209 W. 4 St., Charlotte, N. C., Smith-Pew Constr. Co., 2117 Piedmont Rd. N.E., Atlanta, Ga., and MacDougald Constr. Co., 804 Glenwood Ave. S.E., Atlanta, Ga. Approx. **$25,000,000.** Bids 1/12. CD 1/9—ENR 1/15.

Calif., San Mateo—San Mateo Junior College Dist., 1 story, rein.-con., steel shop, to H. H. Larsen Co., 64 South Park, San Francisco. **$156,923.** CD 5/22—ENR 5/29.

★**†Conn., Bristol** — Div. Defense Housing, FWA, Fairfield, 200 defense housing units, Jerome Ave., Conn. 6091 X, to A. Barbaresi & Son, Inc., 20 E. 1 St., Mount Vernon, N. Y., **$529,700;** utilities, to Rathgeb-Walsh, Inc., 84 N. Main St., Port Chester, N. Y., **$104,525.** Bids 1/5. CD 1/13—ENR 1/15.

†Ga., Macon—U. S. Eng., P. O. Bldg., Savannah, base engineering shop, Cochran Field, to Henry A. Ivey, Decatur. **$97,500.** Bids 1/12. CD 1/9.

★**Ill., Chicago**—Chicago Housing Auth., 834 unit housing, also administration bldg. Project Ill-2-2S, to Patk. Warren Constr. Co., 228 N. La Salle St., **$3,337,000**. USHA. Bids 1/2. CD 12/8—ENR 12/11.

★**†Mass., Watertown**—U. S. Eng., Park Sq. Bldg., Boston, 160x460 ft., brick, steel addn. Bldg. 311, sea coast gun shop, Spec. 9043-E, Watertown Arsenal, to L. P. Soule & Sons Co., 80 Boylston St., Boston. **$538,437.** Bids 1/16. CD 1/20—ENR 1/22.

★**†Mo., St. Louis**—Scullin Steel Co., 6700 Manchester Ave., plant alterations, addns., to Fruin-Colnon Contg. Co., 502 Merchants Laclede Bldg. Est. **$1,200,000.** Defense Plant Corp. will finance. CD 12/8—ENR 12/11.

†N. J., Fort Monmouth—War Dpt., 20 St. and Constitution Ave. N.W., Wash., D. C., twenty-eight 2 story frame barracks, to Stephen J. Day Associates, 601 Mattison Ave., Asbury Park. **$172,000.**

†N. Y., Fort Hamilton (Sta. Brooklyn)—U. S. Eng., 120 Wall St., New York, housing, to Albert A. Lutz Co., Inc., 300 Madison Ave., New York. Over **$400,000.** Bids 1/2. CD 12/17—ENR 12/25.

N. Y., Jamestown—Bd. P. Utilities, City Hall, T. V. McKee, secy., 3,000 kva. substation, Harrison St., to General Electric Co., 1 River Rd., Schenectady. **$42,304.** Est. $40,000. Bids 1/6, awarded 1/20. CD 12/18—ENR 12/25.

★**†N. Y., Lewiston**—War Dpt., 20 St. and Constitution Ave. N.W., Wash., D. C., plant (product unknown), near here, to J. G. White Eng. Corp., 80 Broad St., New York, N. Y. Est. **$20,000,000.**

★**†O., Cleveland**—Republic Steel Corp., Republic Bldg., by-product coke ovens, to Koppers Co., Koppers Bldg., Pittsburgh, Pa., cost plus basis. Total est. **$14,000,000.** Defense Plant Corp. will finance. CD 10/10—ENR 10/16.

★**†O., Warren**—Republic Steel Corp., Republic Bldg., Cleveland, O., coke ovens, to Semet-Solvay Co., 40 Rector St., New York, N. Y. Est. **$2,000,000.** Defense Plant Corp. will finance. CD 10/10—ENR 10/16.

★**†Pa., Mifflin**—Div. Defense Housing, FWA, North Interior Bldg., Wash., D. C., general contract Mifflin-Whitaker defense housing, Project Pa. 36222, to Henry Shafer Lumber Co., N. Grant St., Kittaning, **$1,080,000***** sewer, water and gas lines, to Pitt Constr. Co., Inc., 1235 Wabash Bldg., Pittsburgh, **$85,190***** site imprvs., to Lloyds Builders, Inc., 185 N. Wabash Ave., Chicago, Ill., **$187,220.** Grand total **$1,352,410.** E. D. Stone, 45 Rockefeller Plaza, New York, N. Y., archt. Hill, Heckler, Hoover & Kohankie, 604 Professional Bldg., Pittsburgh, assoc. archts. R. Frame, Empire Bldg., Pittsburgh, electrical engr. A. Dzubay, 74 N. Freemont Ave., Pittsburgh, plumbing and heating engr. CD 1/23 under LB.

★**†Pa., Monessen**—Pittsburgh Steel Co., V. Chartner, ch. engr., Grant Bldg., Pittsburgh, steel mill, separate contracts. Est. **$6,500,000.** Defense Plant Corp. will finance.

★**Pa., Pittsburgh**—Pittsburgh Housing Auth., Dr. B. J. Hovde, administrator, Terrace Village, general contract 282 unit Allegheny Dwellings, Housing Project Pa. 1-5, to Siesel Constr. Co., Flannery Bldg., **$851,785*****plumbing, to Moss & Blakely, 223 Beltzhoover St., **$182,168 ***** electrical work, to Cronenweth Electric Co., Commonwealth Annex, **$53,449.** Grand total $1,087,402. Est. $1,000,000. USHA. Bids 1/6. Bids Jan. 30, heating for above. CD 1/9—ENR 1/15, under LB.

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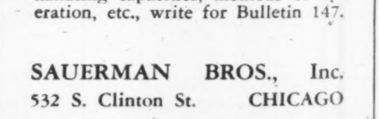

UBLIC BLDGS. (Contracts Awarded, Cont'd.)

†Tex., **Camp Barkeley**—U. S. Eng., Camp Barkeley, additional heating plant unit, facilities, boiler house, service distr. line, etc., to M. Murphy Boiler & Heating Co., Shawnee, Okla. **$50,974.** Bids 1/6. CD 1/2.

†Tex., **El Paso**—Bd. Trustees, L. B. Danis, bus. mgr., Austin Jr. High School, Tex. 41-137, for Independent School Dist., to Robert E. McKee, 1918 Texas St. **$180,700.** Est. $165,000. DPW. Bids 1/15. CD 1/2—ENR 1/8.

★†Va., **Blackstone**—War Dpt., 20 St. and Constitution Ave. N.W., Wash., D. C., cantonment, to Grannis, Higgins, Thompson McDevitt Co., Builders Bldg., Charlotte, N. C. **$26,019,036.** Est. $26,000,000. Bids 1/20. CD 1/22—ENR 1/29, under LB.

P. R., **Rio Piedras**—Puerto Rico Housing Auth., San Juan, general construction, plumbing, heating, electrical work, etc., Rafael Lopez Sicardo Development, 256 units, Project PR 3-9, to Gaspar Roca, Mayaguez. **$420,000.** USHA. Bids 12/30. CD 11/17—ENR 11/20.

Sask., **Regina**—Dpt. National Defense, Ottawa, Ont., 12 frame bldgs., Military Camp, to Shoquist Const. Ltd., 411 Duchess St., Saskatoon. **$193,000.**

COMMERCIAL BUILDINGS

PROPOSED WORK

Calif., **Clearwater** and **Hollydale**—S. V. Hunsaker & Associates, 1027 S. Rives St., Downey, plans by C. N. Aldrich, 1834 Dawson Ave., Long Beach, 50 frame, stucco dwellings, near here. $150,000.

Calif., **Stockton**—Owner, c/o F. V. Mayo, archt., 931 N. El Dorado St., completing plans 35 one story, wood frame homes, Oak Park Court. Over $150,000.

Fla., **Miami**—Miami Development Co., F. Davis, pres., 16 S.W. 23 St., housing, Le Jeune Rd. $200,000.

Ind., **Indianapolis**—S. Arvin, Millersville Rd. at Keystone Ave., 50 homes. $250,000 or more.

★Ia., **Davenport**—Davenport Garden Homes, Inc., Davenport, W. P. Peterson, pres., 500 unit housing, Harbor Rd. Over $1,000,000.

N. J., **Dover**—Kamm Realty Co., c/o F. P. Friedman, archt., 44 Commerce St., Newark, 31 one and one-half and 2 story, bsmnt. frame homes, Hunter St., Roxbury, near here. $176,000.

★N. J., **Jersey City**—Christ Hospital, 176 Palisade Ave., soon lets contract 6 story, 34 x 288 ft., brick, steel, limestone hospital addn., Palisade Ave. $800,000. J. T. Rowland, 30 Journal Square, archt. L. Moe, 921 Bergen Ave., engr. CD 9/30—ENR 10/2.

★N. J., **Piscataway (mail New Brunswick)**—Lake Nelson Homes, Inc., c/o F. P. Friedman, archt., 44 Commerce St., Newark, 200 one and one-half and 2 story, bsmnt., frame, brick homes, Lake Nelson, near here. $1,000,000.

★N. J., **Woodbridge**—Homestead Ridge Development Co., c/o M. M. Plotkin, 786 Broad St., 125 two story, bsmnt., frame homes, Rahway Ave. $625,000.

N. Y., **Olean**—Bd. Trustees St. Francis Hospital, W. State St., brick, steel, concrete hospital addn. $150,000. Applied to DPW. CD 11/25—ENR 11/27.

★O., **Columbus**—I. Gore, 178 High St., and J. Galbreath, 42 E. Gay St., 450 homes, Linden Area, near Curtiss-Wright plant. $1,500,000.

Okla., **Claremore**—Home Building & Realty Co., Claremore, M. Haas, pres., 50 residences. $200,000.

★Okla., **Oklahoma City**—W. P. Atkinson, 1425 W. 23 St., sketches by Hare & Hare, 114 W. 10 St., Kansas City, Mo., 672 homes, business center, site Midwest Air Depot, near here. $3,000,000.

★Okla., **Tulsa**—Adams Building Co., R. E. Adams, Natl. Bank of Tulsa Bldg., 259 residences. $1,000,000.

★Okla., **Tulsa**—M. W. Turner Co., Natl. Mutual Bldg., 250 homes. $1,000,000.

Tex., **Garland**—A. Pollard Simons, 4803 Stanford St., Dallas, 140 frame dwellings. $450,000.

Tex., **Houston**—Houck Realty Co., c/o H. R. Houck, pres., 2102 Telephone St., bids soon, 70 frame dwellings. $300,000.

Tex., **Mission**—Mission Housing Corp., c/o J. H. Sharp, Mission, frame, brick dwellings. $250,000.

Wash., **Spokane**—B. Throop, Sherwood Bldg., 50 houses, Franklin Park Dist., near Wellesley and Division Sts. $200,000.

Alaska, **Ketchikan**—Sisters of St. Joseph hospital addn., $100,000. Seeking DPW funds.

BIDS ASKED

Bids AskeJ February 3

Va., **Hampton**—Dixie Hospital, Hampton, hospital addn. $150,000. Williams, Coile & Pipino, c/o owner, archts.

Bids Asked February 5

N. C., **Raleigh**—Seaboard Air Line Ry., Norfolk, W. D. Faucette, ch. engr., Norfolk, Va., railway station. CD 5/9—ENR 5/15.

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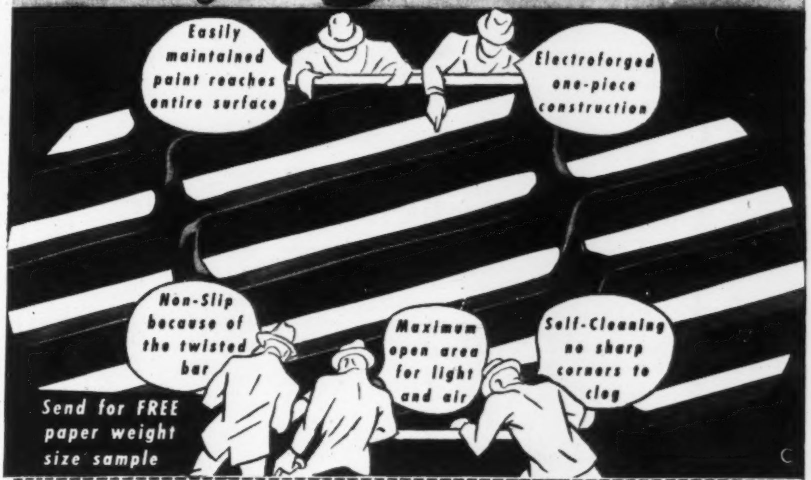
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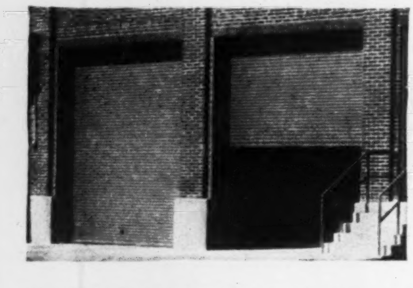

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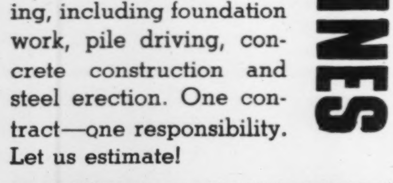

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COMMERCIAL BLDGS. (Contracts Awarded, Cont'd.)

★**Ark., Little Rock** — Arkansas Defense Houses, c/o J. Frazer Smith, archt., Goodwyn Inst. Bldg., Memphis, Tenn., 300 housing units for defense homes, to M. O. Branton, 501 S. Cedar St. Est. **$1,000,000.**

Conn., Bridgeport—Merritt Building Co., Inc., Madison Ave. and Merritt Parkway, about thirty 75x170 ft., Merritt Manor Homes. Owner builds. **$150,000.**

Conn., Fairfield—Jander & Forgione, Inc., 248 Greenwich Ave., Greenwich, 35 homes, Citizens Homes, Inc., Hull Manse Development. Owner builds. **$200,000.**

Conn., Manchester—Manchester Corp., Adams St., 39 frame residences, Crestwood and Foxcroft Rds. Owner builds. **$155,000.** J. E. Kane, 54 Church St., Hartford, archts.

Fla., Orlando—McCrory Stores, Orange Ave. and Pine Sts., 3 story, brick, steel, concrete store, to G. A. Miller Co., Inc., 312½ Twiggs St., Tampa. **$156,000.** Awarded 1/8.

Miss., Columbus—H. Dlugach, Columbus, 100 residences, day labor. **$350,000.**

★**N. J., Asbury Park**—Walter Reade Inc., 701-7 Ave., New York, N. Y., 175 x 250 ft., concrete, tile swimming pool, with dressing rooms, bathhouse and lockers, part recreational development, to Thomas Proctor Co., 218 B.5 St., Long Branch. Total est. **$1,000,000.** CD 12/5—ENR 12/11.

★**N. Y., Brooklyn**—Equitable Life Assurance Society of the United States, 99 William St., New York, N. Y. 10-15 garden type apartments, Clinton Hill, Clinton Ave., Lafayette and Willoughby Aves. to Starrett Brothers & Eken, 40 Wall St., New York. Estimated cost $7,000,000. Harrison, Fouilhoux, & Abramovitz, 45 Rockefeller Plaza, New York, archts. G. D. Clarke, 10 Rockefeller Plaza, New York, landscape archt. E. E. Eshley, mechanical engineer. J. Di Stasio & Co., New York, mechanical engineers.

Pa., Pittsburgh—Universal Const. Co., B. H. and L. H. Harvey, 2420 Ridgeland Pl., Pittsburgh, fifty 1½ story, bsmnt., brick, veneer on frame residences, separate contracts. **$275,000.**

★**Tex., McAllen**—McAllen Bldg. Co., Inc. (A. Thomas, M. R. Nelson and N. E. Buescher), McAllen, 137 dwellings. Owner builds. Approx. **$640,000.** CD 1/8—ENR 1/15.

Tex., Mission—L. Duncan, c/o City Hall, 150 dwellings, own forces. **$640,000.** CO 1/8—ENR 1/15.

Ont., Malton—National Steel Car Corp. Ltd., Kenilworth Ave. N., Hamilton, office, to Tope Const. Co., Ltd., 677 Main St., Hamilton, **$160,000.** Hutton & Souter, Pigott Bldg., Hamilton, archts.

Que., Montreal—St. Justine Hospital Bd., 6055 St. Denis St., 3 story, 25x115 ft., brick, steel hospital addn., concrete fdn., to D. Boileau, Ltd., 245 McDougall St. Est. **$150,000.** J. Sawyer, 1207 Guy St., archt.

INDUSTRIAL BUILDINGS

PROPOSED WORK

Ark., Magnolia—PLANT — Arkansas-Louisiana Gas Co., Slattery Bldg., Shreveport, La., sour gas sweetening plant, Macedonia Field. Over $150,000.

Calif., Kingsburg — BOTTLING PLANT — Central Winery, Inc., Kingsburg, bottling plant and winery bldgs. addns. $200,000.

Calif., Sacramento—PLANT—Hancock Oil Co., 1501 McCormack St., Sacramento, rebuilding plant. $50,000.

Calif., Sacramento—PLANT—Signal Oil Co., 1506 Sproule St., rebuilding plant. $50,000.

Calif., Sacramento—PLANT—Sunshine Biscuit Co., 1531 McCormack St., rebuilding plant. $50,000.

Calif., Sacramento—Weitz Oil Co., Lodi, rebuilding plant. $50,000.

Conn., Bridgeport—PLANT—Producto Machine Co., 990 Housatonic Ave., plans by A. H. Pokras, 436 Salem St., brick, steel milling machine mfg. plant. Over $40,000.

Conn., New Haven — FACTORY — Snow & Petrelli Mfg. Co., 25 Fox St., sketches 2 story, 39x188 ft., brick, steel factory. $75,000. H. Labov, 164 Linden St., engr.

Conn., Stamford—FACTORY—Baer Brothers, 700 Canal St., 2 story, brick, steel factory unit. $50,000.

Conn., Stamford—Factory—Stamford Eng. Wks., J. Bamber, 248 Canal St., plans by C. C. Braun, 2 W. 45 St., New York, 1 story, 50x100 ft., brick, steel factory addn., Canal St. $40,000. CD 1/13—ENR 1/15.

Ill., Libertyville — FACTORY — Frank G. Hough Co., Libertyville, plans by W. D. Mann, 362 Park Ave., Highland Park, factory addn. $80,000.

Ind., Bedford — POWER SUBSTATION — Pub. Serv. Corp. of Indiana, Bedford, high power substation, near here. $100,000 or more with equip.

Ind., Fort Wayne—PLANT—National Can Co., 110 E. 42 St., New York, N. Y., plant. $50,000 or more with equip.

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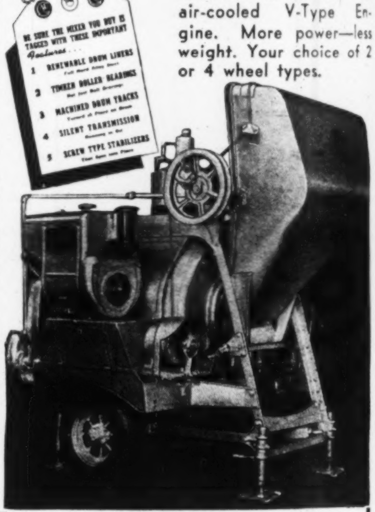

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INDUSTRIAL BLDGS. (Proposed Work, Con.)

Kan., Wichita — PLANT — Cessna Aircraft Co., Wichita, plans by Overend & Boucher, Brown Bldg., plant addn. $50,000.

Md., Baltimore—SERVICE—American Hammered Piston Ring Div. Koppers Co., Bush and Hamburg Sts., soon lets contract, 1 story, brick, steel Service Bldgs. 1 and 2, alterations, addns., rein.-con. fdns. $40,000. CD 1/19—ENR 1/22.

Md., Easton—GRAIN ELEVATOR, etc.—J. M. Willis & Son, Easton, rebuilding 50,000 bu. grain elevator and warehouse. $40,000.

Md., Fairfield (sta. Baltimore)—CARPENTER SHOP—Bethlehem Fairfield Shipbuilding Corp., Fairfield, soon lets contract, 2 story, 50x156 ft. frame carpenter shop, concrete fdn. $60,000.

★**Nev., Las Vegas**—MILL—M. A. Hanna Co., Leader Bldg., Cleveland, O., manganese mill, near here. $4,500,000.

N. J., Passaic—PLANT—Allen B. Dumont Laboratories, Inc., 2 Main Ave., soon lets contract, 2 story, bsmnt., brick, steel, concrete mfg. plant addn., Main Ave. $200,000. Ballinger Co., 105 S. 12 St., Phila., Pa., archts. and engrs.

N. Y., Brooklyn—COMPRESSOR ROOM, etc.—Robins Dry Dock & Repair Co., Erie Basin, plans by Kelly, Syska & Hennessy, 144 E. 39 St., New York, 2 story, 57x142 ft. compressor room, electric transformer substation, motor generator station, tool room, etc. $50,000.

N. Y., Kew Gardens — FACTORY — George Mfg. Co., 103-37 98 St., Ozone Park, plans by G. I. Prowler, c/o owner, 1 story factory, 89-46 127 St. $60,000.

N. Y., Niagara Falls—PLANT—Bell Aircraft Corp., 2050 Elmwood Ave., Buffalo, plant addns., exten., etc. Over $40,000.

O., Akron—PLANT—Enterprise Mfg. Co., 217 Ash St., G. T. Pflueger, genl. mgr., bids soon general contract altering plant, 110 N. Union St. J. F. Mumper, 72 Marshall Ave., engr.

O., East Cleveland (br. Cleveland)—FOUNDRY—Standard Alloy Co., P. G. Lutz, mgr., 1679 Collamer Rd., sketches 1 story, 100x100 ft., brick, steel foundry. $50,000. G. D. Conover, 1740 E. 12 St., Cleveland, consult. engr.

Ore., Baker—PLANING MILL, etc.—Stoddard Lumber Co., Baker, rebuilding planing mill, dry shed, and box factory. $40,000.

Pa., Birdsboro — PLANT — Birdsboro Steel Fdry. & Machine Co., Birdsboro, brick, steel, concrete plant and office addn. $40,000.

Pa., Scranton — PLANT — Keystone Ordnance & Mfg. Co., W. Haggerty, pres., c/o H. J. Snowdon, 1810 Sanderson Ave., mfg. plant. $240,000.

★**Tex., Port Arthur**—PLANT—Texas Co., 720 San Jacinto St., Houston, revised plans lubricating oil mfg. plant, etc. $2,500,000. CD 10/25/40—ENR 10/31/40.

★**Tex., Port Arthur**—PLANT—Texas Co., 720 San Jacinto St., Houston, alkylation plant for 100-octane gasoline manufacture. $7,500,000.

Tex., Texas City—PLANT—Pan-American Refining Corp., Texas City, expanding toluene mfg. plant.

Wash., Tacoma — PLANT — Wheeler-Osgood Corp., 1216 St. Paul St., rebuilding dryer plant, lumber plant. Over $40,000.

B. C., Vancouver—PLANING MILL—Elburne Sawmills Ltd., 9419 Hudson St., planing mill, etc. $40,000.

B. C., Vancouver—MACHINE SHOP—Simplex Engine & Mfg. Co. Ltd., 1963 W Georgia St., machine shop, plant exten. $40,000.

Man., Winnipeg—FOUNDRY, etc.—Monarch Mchy. Co. Ltd., 889 Erin St., foundry, machine shop. $40,000.

Man., Winnipeg—PRINTERY, etc.—Western Publishers Ltd., c/o R. W. Campbell, 811 McArthur Bldg., printery, bookbinding, publishing plant, etc. $40,000.

N. S., Sydney—PLANT—L'Air Liquide Ltd., 111 Beaver Hall Hill, Montreal, Que., plant.

Ont., London — PLANT — E. Shuttleworth Co., R.R. 4, textile plant addn. $40,000.

Ont., New Toronto—FACTORY—Schlegal Co. of Canada, Ltd., 165 Dufferin St., Toronto, factory. $50,000.

Ont., Ottawa—PAPER MILL—J. R. Booth, Ltd., Booth St., bids soon paper mill exten. $70,000.

★**Ont., Sault Ste. Marie**—PLANT EXPANSION—Algoma Steel Corp., 503 Queen St., bids soon, plant expansion, blast furnace, imprv. blast facilities, battery coke ovens, etc. $4,000,000.

Ont., Toronto — WAREHOUSE — Hanks & Irwin, archts., 2890 Bloor St. W., bids soon 1 story, 40x100 ft. storage warehouse, for Atlas Traders, Ltd., 440 Keele St. $40,000.

Ont., Toronto — GARAGE, etc. — Standard Brands, Ltd., Fraser Ave., owner, and J. M. Lyle, archt., 230 Bloor St. W., bids soon garage and warehouse. $72,500 incl. equip. CD 11/17—ENR 11/20.

Ont., Toronto—PLANT—Thos. Pocklintor Ltd., c/o A. M. Matheson, 85 W. Richmond St., mfg. plant. $40,000.

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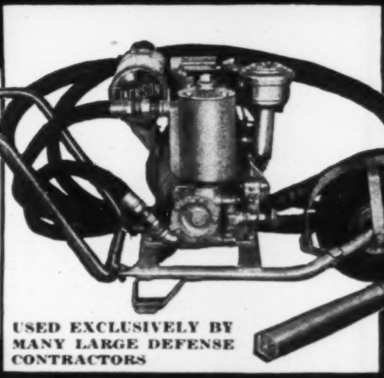

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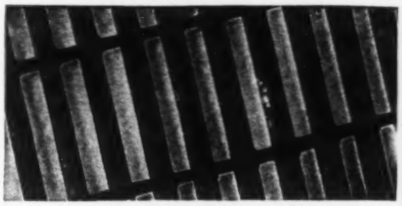

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INDUSTRIAL BLDGS. (Proposed Work, Con.)

Ont., Toronto—PLANT—Precision Dies & Castings, Ltd., 282 St. Helens Ave., plant addn. $40,000. T. Pringle & Sons, Ltd., 36 Toronto St., engrs.

Ont., Toronto—PLANT—Thos. Pocklington Ltd., c/o A. M. Matheson, 85 W. Richmond St., mfg. plant. $40,000.

Ont., Welland—PLANT—Atlas Steels Ltd., 7 Main St., plans by R. I. Mac Beth, 104 Queen St., St. Catherines, plant addn. $50,000.

Ont., Windsor — PLANT — Ramsasy Accessories Mfg. Corp. Ltd., c/o T. W. Whiteside, K.C., Windsor, plant. $40,000.

Ont., Woodstock—PLANT—Huddleston & Barney Ltd., Woodstock, printing, engraving and lithographing plant. $40,000.

★**Que., La Tuque**—PLANT—R. A. Rankin & Co., engrs., 1420 Sherbrooke St. W., Montreal, soon let contract plant addns. for Braun Corp., La Tuque. $650,000. CD 1/16—ENR 1/22.

Que., Magog—FACTORY—L & L Textiles, Ltd., Magog, clothing, etc., factory. $40,000.

Que., Montreal—SUB-STATION — Montreal, Light, Heat & Power Co., 107 Craig St. W., bids soon, completion sub-station, St. James and Guy Sts. $115,000.

Que., Montreal—FACTORY—C. P. Ouimet Shoe Co. Ltd., c/o G. McTeigue, 132 St. James St. W., factory. $45.000.

Que., Montreal—PLANT—Albert Rakovsky Precision Wks. Ltd., c/o M. Trudeau, 132 St. James St. W., plant. $40,000.

Que., Montreal—FACTORY—Redfern Textiles Corp. Ltd., c/o S. Greenblatt, Dominion Sq. Bldg., factory, $40,000.

Que., Roberval — FACTORY — Gagnon & Brothers Ltd., Roberval, sash and door factory. $40,000.

BIDS ASKED

Bids Asked February 2

Kan., Kansas City—PACKING PLANT—Swift & Co., 10 and Berger Sts., 6 story packing plant addn. Over $40,000.

Bids Asked About February 3

Vt., Brattleboro — GRINDING BUILDING, etc.—American Optical Co., 14 Mechanic St., Southbridge, Mass., superstructure 1 story, 160x420 ft., brick, steel grinding bldg., power and garage bldg. Hayden, Harding & Buchanan, Park Sq. Bldg., Boston, Mass., engrs. Concrete fdn. awarded to H. P. Cummings Constr. Co., 14 Prospect St., Ware, Mass. CD 12/29—ENR 1/1.

Bids Asked

Conn., Glenbrook (sta. Stamford)—FACTORY—Electric Indicator Corp., 23 Parker Ave., remodeling wing, constructing wing addn., altering garage into factory. $40,000. F. S. Massari, 200 Atlantic St., Stamford, archt.

N. J., North Bergen—WAREHOUSE—Callite Tungsten Corp., 549 39 St., Union City, bids soon 1 story, 85x85 ft., brick, steel warehouse. Over $40,000. F. A. Hecker, 6030 Bergenline Ave., West New York, archt.

N. M., Artesia — PLANT EXPANSION — Malco Refineries, Inc., Artesia, expansions, imprvts. cracking and skimming plants. CD 1/8—ENR 1/22.

CONTRACTS AWARDED

Calif., Los Angeles—SHOP—General Electric Realty Corp., 1 River Rd., Schenectady, N. Y., 1 story, part 2 story shop bldg., 733 Banning St., to Ford J. Twaits Co., 451 S. Boylston Ave., approx. **$70,000.** A. C. Martin, 233 Higgins Bldg., archt.

Calif., San Francisco—SECTION HOUSE—Atchison, Topeka & Santa Fe Ry., M. C. Blanchard, ch. engr. (coast lines), 560 S. Main St., Los Angeles, section house and bunkhouse, to Barrett & Hilp, 918 Harrison St. **$45,000.**

Calif., San Jose—PLANT—American Dairy, 795 E. Santa Clara St., plant addn., to G. L. Honore, 136 Race St. **$42,500.**

Md., Fairfield (sta. Baltimore)—WAREHOUSE — Bethlehem Fairfield Shipbuilding Corp., Fairfield, 2 story, 50x400 ft., brick, steel warehouse, concrete fdns., to Cummins Constr. Corp., 803 Cathedral St., Baltimore. **$200,000.**

Md., Sparrows Point (br. Baltimore)—FACTORY—Rheem Mfg. Co., 30 Rockefeller Plaza, New York, N. Y., 1 story, 100x250 ft. factory, to Brown & Matthews Co., 122 E. 42 St., New York, N. Y., **$100,000.**

★**Mass., Waltham** — FACTORY — Raytheon Mfg. Co., 55 Chapel St., Newton, 2 story, 200x320 ft., brick, steel factory, Willow St., to Austin Co., 19 Rector St., New York, N. Y. Est. **$1,250,000.**

Mo., St. Louis—FREIGHT TERMINAL—Owner, c/o F. R. Nauman, archt., 4710 Washington Ave., altering, constructing 1 story, 104x140 ft., brick freight terminal addn., 928-930 Chouteau Ave., to W. C. Harting Constr. Co., 722 Chestnut St.

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NDUSTRIAL BLDGS. (Proposed Work, Con.)

N. J., **Elizabeth**—RAILROAD BUILDINGS—Central Railroad of N. J., A. E. Owen, ch. engr., Reading Terminal, Phila., Pa., two 2 story, bsmnt. railroad bldgs., to Calabro Constr. Co., 527 4 Ave., **$40,000.** Bids 1/6, CD 1/2.

N. J., **Rahway**—ASPHALT PLANT—Lewis Asphalt Eng. Co., 30 Church St., New York, N. Y., rebuilding asphalt plant, Clark, near here, to A. Milne, 20 Race St., North Plainfield.

O., **Barberton** — FACTORY — Electro Metal Casting Co., Barberton, 1 story, brick, steel factory addn., Huston St., to Clemmer Constr. Co., Cordelia Ave., Akron. **$50,000.** Awarded 1/16.

O., **Cleveland**—FACTORY—Eaton Mfg. Co., 14200 Darley Ave., 210x242 ft., brick, steel factory, to Cleveland Const. Co., 3866 Carnegie Ave. Est. **$150,000.** George S. Rider Co., Terminal Tower, engr.

O., **Cleveland** — FACTORY — Mooney Iron Wks. Co., A. Mooney, pres., 3319 E. 80 St., 1 story, 60x165 ft., brick, steel factory, to A. M. Higley & Co., 2036 E. 22 St. Est. **$40,000.**

O., **Cleveland** — FACTORY — National Acme Co., F. H. Chapin, pres., 170 E. 131 St., 1 story, 52x600 ft., brick, steel, factory addn. to Cleveland Constr. Co., 3866 Carnegie Ave. Est. **$150,000.** George S. Rider Co., Terminal Tower, engrs.

O., **Cleveland**—FACTORY—National Bronze & Aluminum Fdry. Co., J. L. Schmeller, pres., 800 Laisy Ave., factory interior alterations, to H. L. Vokes Co., 5300 Chester Ave. Est. **$40,000.** A. Simon, 5300 Chester Ave., engr.

O., **Cleveland** — FACTORY, etc. — Wellman Bronze & Aluminum Co., F. S. Wellman, pres., 6017 Superior Ave., rebuilding 30x120 ft., brick, steel warehouse and factory, 21x52 ft. and 52x55 ft. wings, to H. G. Slatmyer & Son Const. Co., 203 Lakeside Ave. Est. **$40,000.** CD 1/14—ENR 1/22.

Pa., **East Pittsburgh**—FACTORY—Westinghouse, Electric & Mfg. Co., East Pittsburgh, 2 story, 75x100 ft., brick, steel, concrete factory, separate contracts.

Pa., **Erie**—PLANT—Hammermill Paper Co., E. Lake Rd., 1 story, brick, steel, concrete bleaching plant addn., to Henry Shenk Co., Sassafras St. Est. **$40,000.**

Pa., **Grove City**—STORAGE—Cooper-Bessemer Corp., Grove City, G. LeFevre, genl. mgr., 1 story, 140x280 ft. finished materials storage bldg., Lincoln Ave., 1 story, brick, steel pattern storage bldg., E. Pine St. exten., to Austin Co., 16311 Euclid Ave., Cleveland, O. Est. **$171,000.**

Pa., **Harrisburg**—FLANGING SHOP—Central Iron & Steel Co., S. Front St., 216x256 ft. flanging shop addn. Owner builds. **$67,000.**

Pa., **Latrobe** — PLANT — Prack & Prack, archts., 517 Martin Bldg., NS., Pittsburgh, 2 story, rein.-con. plant addn., to J. C. Yenter, Commerce Bldg., Tyrone, for American Locomotive Co., N. Jay St., Schenectady, N. Y. Est. **$60,000.** CD 11/27—ENR 12/4.

Pa., **Meadville**—WAREHOUSE—Reick McJunkin Dairy Co. E. E. Stewart, pres., 20 Stevenson St., Pittsburgh, general contract 1 story, L-shaped, 102x183 ft., tile or concrete block warehouse, to Ortman & Reitze, 201 Allegheny St.***electrical work, to Daisley Elec. Co., Greenville***heating, to L. L. Lord Co., Race St. and Erie R. R. Kaiser, Neal & Reid, 801 Keystone Bldg., Pittsburgh, archts.

★Pa., **Montoursville**—PLANT—C. Wagner, archt., 13 W. 4 St., Williamsport, general contract, brick, steel, concrete radio products plant, for Hygrade Sylvania Corp., H. W. Zimmer, genl. mgr., to Henry E. Baton, Inc., 1713 Sansom St., Phila.***plumbing, heating, to E. Keeler Co., 238 West St., Williamsport*** sprinkler systeme, to Globe Automatic Sprinkler Co., 2035 Wash. Ave., Phila. Est. **$500,000** with equip. Bids 1/5. CD 12/30—ENR 1/8.

Pa., **Scranton**—WINERY—Brookside Distilling Products Corp., J. M. Gentile, mgr., Remington Ave. and Breck St., 55x175 ft., winery addn., separate contracts. **$50,000.**

Pa., **Sharon**—PLANT—Petroleum Iron Wks., Sharon, 40x200 ft., frame, steel, concrete main steel drum mfg. bldg. addn., to P. Glenn, Sharon. Est. **$40,000.**

Tenn., **Memphis** — WAREHOUSE — H. C. Cole Milling Co., 1728 Evelyn Ave., warehouse, to B. E. Buffaloe, 1574 Lamar Ave. Est. **$75,000.** Horner & Wyatt Bd. Trade Bldg., Kansas City, Mo., engrs.

Tex, **Ennis**—PLANT—Oak Farms Dairy, 1114 N Lancaster St., Dallas, cheese and milk processing plant, day labor, sub-contracts. **$45,000.** CD 1/16—ENR 1/22.

Tex., **Wichita Falls** — POWER PLANT — Perkins Timberlake Dept. Store, 9 and Indiana Sts., electric power plant. Owner builds. **$40,000.** J. E. Ward, Harvey-Snider Bldg., Wichita Falls, engr. CD 12/27/40—ENR 1/2/41.

Ont., **Renfrew**—PLANT—Renfrew Electric & Refrigerations Co. Ltd., Renfrew, plant reconstruction and exten., to M. J. Sulphur & Son, Ltd., 14 Lisgar St. Est. **$40,000.**

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Bids: February 3 (798)

Wells

STATE OF ILLINOIS
DEPARTMENT OF PUBLIC WORKS AND BUILDINGS
DIVISION OF WATERWAYS

Sealed proposals for furnishing all labor, services, equipment, materials and doing all work necessary for the drilling, casing, sealing, testing and purging of two (2) domestic water supply wells in Channahon Township, Will County, Illinois, and one (1) domestic water supply well in Aux Sable Township, Grundry County, Illinois, will be received by the State of Illinois, Department of Public Works and Buildings, Division of Waterways, 201 West Monroe Street, Springfield, Illinois, until 10:00 A.M., Central Standard Time, February 3, 1942, and then publicly opened and read.

The work shall be performed in accordance with the specifications on file in the office of the Division of Waterways, 201 West Monroe Street, Springfield, Illinois, and in the Chicago District Office of the Division of Waterways, Room 1424, 188 West Randolph Street, Chicago, Illinois, and in the Maintenance Office of the Division of Waterways, 803 State Street, Lockport, Illinois, at which places they may be obtained free of charge by interested parties. The prevailing wages to be paid on said work are as listed in said specifications.

Each proposal shall be accompanied by a Bank Cashier's Check or Bank Draft in the amount of at least ten (10) per cent of the total amount of the bid.

The State reserves the right to reject any or all bids.

Carter Jenkins
Chief Engineer
January 19, 23, 29, 1942

Bids: February 4 (802)

Pipe Sewers

DEFENSE PUBLIC WORKS PROJECT
NO. MD. 18-150
WASHINGTON SUBURBAN SANITARY COMMISSION

Sealed bids for Contract No. 1, Defense Public Works Project Md. 18-150 for the construction of approximately 100 feet of 8-inch, 870 feet of 10-inch and 1,225 feet of 12-inch vitrified pipe sewers and 5,160 feet of 24-inch reinforced-concrete pipe sewers will be received by the Washington Suburban Sanitary Commission, at the office of the Commission, Hamilton Street, Hyattsville, Maryland, until 3:00 P. M., Eastern Standard Time, Wednesday, February 4, 1942, and then at said office, publicly opened and read aloud.

The Information for Bidders, Form of Bid, Form of Contract, Plans, Specifications, and Forms of Bid Bond and Performance Bond may be examined at said office and copies thereof obtained upon payment of $5.00 for each set. Any bidder, upon returning such set promptly and in good condition, will be refunded his payment, and any non-bidder upon so returning such set will be refunded $5.00.

The Washington Suburban Sanitary Commission reserves the right to waive any informalities in or to reject any or all bids.

Each bidder must deposit with his bid security in an amount of not less than five per centum (5%) of the base bid in the form and subject to the conditions provided in the Information for Bidders.

Attention of bidders is particularly called to the requirements as to conditions of employment to be observed and minimum wage rates to be paid under the contract.

No bidder may withdraw his bid within 30 days after the actual date of the opening thereof.

PERRY BOSWELL,
J. DONALD CLAGETT,
FRANK B. SMITH,
Commissioners.

(U. S. Government)

WAR DEPARTMENT, U. S. Engineer Office, 8th floor, Standard Oil Building, St. Paul Place and Franklin Street, Baltimore, Maryland. Sealed bids, in duplicate, will be received here until 11:00 A. M., E.S.T., February 4, 1942, and then publicly opened for furnishing all plant, labor and materials (except material furnished by the Government), and performing all work required for the *construction of one relief culvert and appurtenant works, complete*, located in the City of Wilkes-Barre, Luzerne County, Pennsylvania. Plans and specifications are available upon receipt of certified check in the amount of $15.00 made payable to the "Treasurer of the United States". Further information upon application. (779)

U. S. ENGINEER OFFICE, P. O. Box 59, Louisville, Ky. Sealed bids will be received here until 11:00 A. M. (C.S.T.), February 6, 1942, and then opened for the *construction of one Triangular Division Cantonment,* which includes buildings, roads, drainage and grading, sewers, water and gas distribution, electrical distribution system, and water supply and sewage treatment plants near Columbus, Indiana. One hundred dollars deposit required for plans and specifications. Plans and specifications may be seen at the U. S. Engineer Offices, Louisville, Ky.; Cincinnati, Ohio; Pittsburgh, Pa.; Chicago, Ill.; and St. Louis, Mo. Further information on application. (800)

U. S. ENGINEER OFFICE, Wilmington, N. C. Sealed bids, in duplicate, will be received until 12:00 Noon E.S.T., February 3, 1942, and then publicly opened, for furnishing all labor and materials and performing all work for *dredging, clearing, and the construction of seaplane ramp and apron at Manteo Airport, Manteo, N. C.* Further information upon application. (789)

WAR DEPARTMENT: United States Engineer Office, Galveston, Texas. Sealed bids will be received until 2:00 P.M., C.S.T., February 20, 1942, and then publicly opened for furnishing all labor and materials and performing all work for *repairing the north jetty* at Galveston Harbor, Texas from Station 184+75 to Station 160+00. A distance of about 2475 feet. Further information on application. (806)

U. S. ENGINEER OFFICE, Jacksonville, Fla. Sealed bids, in duplicate, will be received here until 10 a.m., E.S.T. (D.S.T.), February 9, 1942, and then publicly opened, for furnishing all plant, labor, and materials and *performing all work for maintenance dredging* in the section of the Intracoastal Waterway, Jacksonville to Miami, Fla., between the vicinity of Sebastian, Fla., and Miami, Fla. (Ship Channel, Turning Basin), consisting of removal of approximately 491,795 cu.yds. of shoal material and settling basin excavation. Further information on application. (808)

(U. S. Government)

FEDERAL WORKS AGENCY, Public Roads Administration, Washington, D. C., January 17, 1942. SEALED BIDS will be received at the office of the District Engineer, Public Roads Administration, Room 123, Winder Building, 17th and F Streets, N. W., Washington, D. C., until 11:00 o'clock, a. m., E. S. T., February 3, 1942, for the *construction of Bridges* Nos. 7 and 8, War Department Building—Road Network, Arlington County, Virginia. The approximate quantities of the more important items are as follows: 3,000 Cu. Yd. Excavation; 5,130 Cu. Yd. Cement Concrete; 770,000 Lb. Reinforcing Steel; 525 Cu. Yd. Stone Masonry; 27,000 Lin. Ft. Concrete Piling. Minimum rates of wages for laborers and mechanics on this project have been fixed by the Secretary of Labor as required by law. Plans, specifications and proposal forms may be obtained at the office of the District Engineer. Public Roads Administration, Room 123 Winder Building, 17th and F Streets, N. W., Washington, D. C. H. J. Spelman, District Engineer. (805)

WAR DEPARTMENT, U. S. Engineer Office, 613 Federal Building, Detroit, Michigan. Sealed bids will be received until 11:00 o'clock, A.M., E.S.T., February 9, 1942, and then publicly opened for the *construction of soil cement runway, taxiway and apron pavements, and furnishing and installing tie-down anchors at Camp Skeel, Oscoda, Michigan.* Further information on application. (807)

Contractors,
LIKE ARMIES,
Need
Modern Equipment...

CONSTRUCTION work is WAR—a struggle against stubborn natural forces—Today carried on by mechanized man-power.

And the equipment must be modern and efficient, for the Contractor to win his war.

Contractors bidding on Public Works, advertised in these pages, will be interested in looking through the rest of the advertising pages, and seeing the big improvements manufacturers have made in cranes, power shovels, draglines, tractors, wheeled-scrapers. . . .

Here is the place to keep pace with improvements in modern construction equipment, tools, and materials. This will enable you to bid low enough to "land the job"—and—make money on it. Watch the newspaper of the engineering construction field — ENGINEERING NEWS-RECORD.

THE MOST FOR THE MONEY — *SPEED - EFFICIENCY - ECONOMY*
CONSTRUCTION BY CONTRACT
THE ASSOCIATED GENERAL CONTRACTORS OF AMERICA, INC. - MUNSEY BLDG., WASH. D.C.

OFFICIAL PROPOSALS

ids: February 17 (810)

ronze Pipe and Nozzle Castings

CONTRACT 374

SEALED BIDS will be received by the oard of Water Supply, at its offices, eventh floor, 346 Broadway, New York, Y., until 11:00 A.M. (time as fixed by ct of Congress, effective February 9, 1942), Tuesday, February 17, 1942, for Contract 74, for furnishing, testing and delivering ronze pipe and nozzle castings, bronze per pins, double-ended bronze stud bolts, eel bolts and bronze and steel nuts for the ondout and West Branch effluent chambers the Delaware aqueduct, all as set forth the specifications.

The Office of Production Management as issued to the Board of Water Supply n order assigning a preference rating of -4 to the portion of the Delaware Water upply System included in this contract.

No bid will be received and deposited unless accompanied by a certified check pon a National or State bank, drawn and ade payable to the order of the Comproller of The City of New York, in the mount of twenty thousand dollars ($20,000.00), for the proper execution of he contract.

At the above place and time the bids ill be publicly opened and read. Pamphets containing information for bidders, orms of bid and contract, specifications, ontract drawings, requirements as to urety, etc., can be obtained at the office of he Secretary at the above address, upon pplication in person or by mail, by depositing the sum of five dollars ($5.00) in ash or its equivalent for each pamphlet. Within 30 days following the award of ontract or rejection of bids, the full amount of such deposit will be refunded for each pamphlet submitted as a bid and a refund of four dollars ($4.00) will be made for each other pamphlet returned in acceptable condition. Arrangements will be made whereby prospective bidders desiring blueprints of the contract drawings for their own use may secure same, the cost thereof to be paid by them. For further particulars apply at the office of the Chief Engineer at the above address.

GEORGE J. GILLESPIE, President, HENRY HESTERBERG, RUFUS E. McGAHEN, Commissioners, Board of Water Supply; RICHARD H. BURKE, Secretary.

Bids: February 17 (811)

Stop Shutter Frames

CONTRACT 377

SEALED BIDS will be received by the Board of Water Supply, at its offices, eleventh floor, 346 Broadway, New York, N. Y., until 11:00 A.M. (time as fixed by Act of Congress, effective February 9, 1942), on Tuesday, February 17, 1942, for Contract 377, for furnishing and delivering sixteen 5-foot by 20-foot alloy cast-iron stop shutter frames for the Rondout effluent chamber of the Delaware aqueduct, all as set forth in the specifications.

The Office of Production Management has issued to the Board of Water Supply an order assigning a preference rating of A-4 to the portion of the Delaware Water Supply System included in this contract.

No bid will be received and deposited unless accompanied by a certified check upon a National or State bank, drawn and made payable to the order of the Comptroller of The City of New York, in the amount of ten thousand dollars ($10,000.00), for the proper execution of the contract.

At the above place and time the bids will be publicly opened and read. Pamphlets containing information for bidders, forms of bid and contract, specifications, contract drawing, requirements as to surety, etc., can be obtained at the office of the Secretary at the above address, upon application in person or by mail, by depositing the sum of five dollars ($5.00) in cash or its equivalent for each pamphlet. Within 30 days following the award of contract or rejection of bids, the full amount of such deposit will be refunded for each pamphlet submitted as a bid and a refund of four dollars ($4.00) will be made for each other pamphlet returned in acceptable condition. Arrangements will be made whereby prospective bidders desiring blueprints of the contract drawing for their own use may secure same, the cost thereof to be paid by them. For further particulars apply at the office of the Chief Engineer at the above address.

GEORGE J. GILLESPIE, President, HENRY HESTERBERG, RUFUS E. McGAHEN, Commissioners, Board of Water Supply; RICHARD H. BURKE, Secretary.

Where EVERY DAY COUNTS
Reach your CONSTRUCTION MARKET PROSPECTS
3 days . . . 5 days . . . 10 days sooner
***through the* ENGINEERING NEWS-RECORD**
CONSTRUCTION DAILY NEWS SERVICE

Construction at the rate of over $25,000,000 per day is going under contract, bids are called on more work and still more is proposed.

Each of these stages is a selling stage, each is reported in the Daily.

Every month it directs you to new construction worth $500,000,000. Its cost is only $10.

USE THIS CONSTRUCTION REPORT SERVICE:

for direct sales—by salesmen, by mail

for continuous advertising to reach prospects at the height of buying interest

for spotting the most important prospects for special attention

for guiding your sales activity to the most productive business areas and to high priorities business

Ride the new construction business wave, order your service to start now.

Business News Department
McGraw-Hill Publishing Co., Inc.
330 West 42nd St., New York City

Where To Buy
Products • Specialties
Services for the
construction industry

ASPHALT PLANTS
DRYERS - Aggregate
KETTLES - Heating
VIBRATORS - Concrete
White Mfg. Co.
ELKHART INDIANA
Write for Circular on type, sizes and prices

CONCRETE BOND
Living-Stone bonds new concrete to old—for patching and resurfacing—in use since 1905. Contains no acids. Cost 1c per sq. ft.
Full details on request
LIVING-STONE COMPANY
1804 W. Lanvale St. Baltimore, Md.

OFFICIAL PROPOSALS

Bids: February 11 (809)

Sewer Construction

WASHINGTON SUBURBAN SANITARY COMMISSION

Sealed proposals for constructing approximately 3,835 feet of 15-inch and 2,710 feet of 18-inch vitrified pipe sewers and 2,460 feet of 21-inch reinforced-concrete pipe sewers on Contracts Nos. 150-S and 151-S will be received at the office of the Washington Suburban Sanitary Commission, Hamilton Street, Hyattsville, Maryland, until 3:30 P. M., Eastern Day Light Savings Time, Wednesday, February 11, 1942, at which place and time they will be publicly opened and read.

Plans and specifications may be obtained from Harry R. Hall, Chief Engineer of the Commission, Hyattsville, Maryland, upon deposit of $5.00, which deposit will be returned to bidders, or to those returning plans and specifications in good condition.

Perry Boswell
J. Donald Clagett
Frank B. Smith
Commissioners

Delivery vs. Delay . . .
When knowing where to find what you need is the deciding factor between DELIVERY and DELAY . . . consult the advertising pages. If they do not tell where to find what you need . . . write
Engineering News-Record

Many prominent contractors find our "Coast-to-Coast Service" of great advantage to them. It works!
ÆTNA CASUALTY & SURETY COMPANY
Hartford, Conn.
CONTRACT BONDS FOR RESPONSIBLE CONTRACTORS
Agents Everywhere

SEARCHLIGHT SECTION

EMPLOYMENT • BUSINESS • OPPORTUNITIES • EQUIPMENT—USED or RESALE

UNDISPLAYED RATE:

10 cents a word, minimum charge $2.00.

POSITIONS WANTED (full or part-time salaried employment only). ½ the above rates, payable in advance. (See ¶ on box Numbers.)

PROPOSALS, 50 cents a line an insertion.

INFORMATION:

BOX NUMBERS in care of any of our New York, Chicago or San Francisco offices count 10 words additional in undisplayed ads.

DISCOUNT of 10% if one payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED—RATE PER INCH:

The advertising rate is $6.25 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page.

E.N.R

NEW ADVERTISEMENTS received by February 5th appear in February 12th issue subject to limitations of space available

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WANTED!

Engineers—Draftsmen by Curtiss-Wright

Engineers and draftsmen not now employed on defense work. Men between the ages of 24 and 36 with at least three years' experience in engineering and drafting.

Opportunity offers immediate employment. Apply now in person or make application by mail, addressing any of the plants listed below.

Dept. J
Curtiss-Wright Corporation
AIRPLANE DIVISION
Buffalo, N.Y. Columbus, O. St. Louis, Mo.

POSITIONS VACANT

(See also "Selling Opportunity" Offered)

DRAFTSMEN WANTED—Experienced structural steel detailers and checkers. Give full particulars in first application. American Bridge Company, Ambridge, Pa.

STRUCTURAL DETAILERS, accurate and fast workers, experienced on Mill Buildings and Bridges. Permanent job with much overtime. State rate. Summer Engineering Company, 239 4th Ave., Pittsburgh, Pa.

CIVIL AND MECHANICAL Engineers, Draftsmen and Field Parties needed for defense projects. Experience on housing projects would be valuable but not necessary. Submit record of experience and salary expected. P-520, Engineering News-Record, 330 W. 42nd St., New York City, N. Y.

ERECTION AND RIGGING FOREMAN, experienced steel buildings and heavy machinery. Job located in deep South and good for about one year. Applicant must be capable of directing several gangs of riggers and ironworkers, and be thoroughly experienced in rigging methods and equipment. Needed March 1st. P-536, Engineering News-Record, 520 N. Michigan Ave., Chicago, Ill.

GRADUATE mechanical engineers with several years experience engineering and design, all mechanical phases steam electric stations. Write giving full particulars, age, education, experience, salary expected. Employment New York City. P-537, Engineering News-Record, 330 W. 42nd St., New York City.

YOUNG graduate mechanical engineers, one or two years out of college; good opportunity learn all phases engineering and design, steam power stations, heat balances, etc. Write giving full particulars, age, education, salary expected, previous experience, if any. Employment New York City. P-538, Engineering News-Record, 330 W. 42nd St., New York, N. Y.

(Continued on Opposite Page)

WANTED

ENGINEERS & DRAFTSMEN

SERVICE IN NEW YORK

Mechanical & Electrical Engineers

Mechanical & Electrical Engineering Draftsmen

MUST BE AMERICAN CITIZENS

Those now employed in defense industry will not be considered unless they obtain written release from present employer.

Applicants must be fully experienced with records of accomplishment on large projects of diversified structures actually built. Immediate consideration given to applications accompanied by complete information as to age, nationality, education and previous work record.

INTERVIEWS will be promptly arranged with qualified applicants.

Address reply to

EMPLOYMENT DEPT.

JAMES STEWART COMPANY ASSOCIATES

71 Vanderbilt Avenue New York, N. Y.

ENGINEERS, DESIGNERS, DRAFTSMEN:

Do you want to get into Defense Projects?

Dravo Corporation has desirable openings for capable U. S. Citizens for work on large Gantry Cranes, Ore Bridges and Ships including mechanical, electrical and structural steel parts.

In reply give full details regarding age, education, experience, present earnings and references which will not be used without applicant's permission.

Personal interviews will be arranged with qualified applicants.

DRAVO CORPORATION
Engineering Works Division
Neville Island Pittsburgh, Penna.

WANTED

Construction Engineers

With C.E., M.E., or E.E. degree who have had experience on industrial plant construction, power house construction and/or equipment installation to work on construction of national defense plants being built for our Government in the South and Middle West.

Give full details regarding experience, state age, college, year graduated, degree, citizenship, present salary, salary expected, by whom employed and give references in reply. Enclose small photograph.

E. I. duPont de Nemours & Co.
Personnel Division
Wilmington, Del.

WANTED

For Nearby Latin America

Field Engineers, Designers, Superintendents, Foremen, Mechanics and Accountants

Port, terminal, utilities, structural and highway work

Six months or one year contract

First letter must state age, family, education, detailed experience, salary and earliest date of availability. Applications strictly confidential.

P-517, Engineering News-Record
330 West 42nd St., New York City

A COURSE OF INSTRUCTION BY MAIL IN

STRUCTURAL ENGINEERING

Thirtieth Year

(In the following list, Courses A, B, and C are abbreviated from our complete Structural Engineering course).

- **A—Public Works Structures.**
- **B—Architectural Engineering.**
- **C—Special Course (State Board Exams, for P.E.)**
- **D—Structural Engineering (complete).**
- **E—Preparatory Course (for non-technical men).**

Our Courses are offered principally to

ADULT CIVIL ENGINEERS AND ARCHITECTS

Ninety percent of our engineering students are former graduates (C.E.) from engineering colleges. Our courses have helped thousands of engineers to better positions, increased pay, and success "after forty".

Course B has helped many architects and draftsmen in passing the structural portion of State Board Examinations for license.

Literature sent without expense or obligation. **Write TODAY.**

WILSON ENGINEERING CORPORATION

College House Offices Harvard Square Cambridge, Mass., U. S. A.

SALARIED POSITIONS

$2,500 to $25,000

This thoroughly organized advertising service of 32 years' recognized standing and reputation carries on preliminary negotiations for positions of the caliber indicated above, through a procedure individualized to each client's personal requirements. Several weeks are required to negotiate and each individual must finance the moderate cost of his own campaign. Retaining fee protected by a refund provision as stipulated in our agreement. Identity is covered and, if employed, present position protected. If your salary has been $2,500 or more, send only name and address for details.

R. W. BIXBY, INC.

272 Delward Bldg., Buffalo, N. Y.

EMPLOYMENT SERVICE

(Continued From Opposite Page)

EXECUTIVES AND TECHNICAL MEN. Qualified candidates desiring $2,000 to $20,000 positions may contact employers through our confidential services, established 26 years. The National Business Bourse, 20 W. Jackson Blvd., Chicago.

POSITIONS WANTED

STRUCTURAL ENGINEER, thirty years experience steel concrete. Last 15 months on rush Government work expert on stress analysis available for responsible work. Present earnings $125 to $150 week. PW-494, Engineering News-Record, 330 W. 42nd St., New York, N. Y.

SUPERINTENDENT, age 37 experienced in housing and general building construction. Earnest, resourceful and energetic. Excellent references. PW-497, Engineering News-Record, 330 W. 43nd St., New York, N. Y.

SUPERINTENDENT OF CONSTRUCTION, 20 years industrial and high class finished buildings, references. Anywhere. Salary $6000. PW-502, Engineering News-Record, 330 W. 42nd St., New York, N. Y.

CIVIL ENGINEER. 20 years experience. Design. Estimating. Purchasing and management. Public and Industrial Buildings. Graduate C.E. Degree. PW-508, Engineering News-Record, 330 W. 42nd St., New York, N. Y.

WATER WORKS EXECUTIVE ENGINEER desires permanent position with Public Water Supply or Industry. Seventeen years efficient supervision of engineering, construction, maintenance, operation and industrial problems. Distribution system design, pump specifications; test, water treatment, waste surveys, flow studies, meter maintenance, office routine, purchasing, etc. PW-495, Engineering News-Record, 330 W. 42nd St., New York, N. Y.

ENGINEER AND CONSTRUCTION Superintendent with B.S. and C.E. degrees. Experienced in handling Commercial and Industrial Building Construction. Familiar with government contract procedure. Has built U. S. Post Offices and Coast Guard Stations. Steel, Concrete, Brick and Heavy timber experience. Operated own business. Available now. Location immaterial. PW-514, Engineering News-Record, 330 W. 42nd St., New York, N. Y.

SAFETY ENGINEER — Supervisor of Safety and Labor Relations—15 years Superintendent and engineer in responsible charge on general construction. 7 years supervisor of Safety Engineering and Labor Relations on heavy construction. Thoroughly familiar with details Federal Contract procedure and requirements. 42—Single—Good Health—available. Any location. PW-509, Engineering News-Record, 68 Post Street, San Francisco, Cal.

Executive Engineer

At present hold responsible position in non-defense industry. Age 39. Degrees M.E. and C.E. 18 years broad experience. Surveys, Construction, Design & Layout, Service, Sales, Operations, Supervision, Financing, Management, Speak Spanish. Ability to organize and produce results.

PW-518, Engineering News-Record
330 W. 42nd St., New York City

POSITIONS WANTED

SUPERINTENDENT. Thirty years experience on heavy construction, heavy excavation, dams, railroad, roads, sewers, water mains recently finished large ordnance works. Best references. PW-512, Engineering News-Record, 520 N. Michigan Ave., Chicago, Ill.

GRADUATE CIVIL ENGINEER, registered in N. Y., Tenn., Ga. Thirty years experience Dam, Dock, Tunnel River regulating works, Sewer, Water Supply, Highways, Bridges, Canal Army Camp, Building construction. Immediately available. Address G. Y. c/o Dr. Rhodenhiser, 316 2nd St., Macon, Ga.

SURVEYOR, Licensed past fifteen years; seven years highway; four years subway construction. Available immediately. Go anywhere, 31 Arbutus Ave., Huguenot Park, S. I., N. Y.

TRACK MAN. Thirty years experience laying switches and track, over hollow or water, also for mine and tunnel. John Matkovich, Grand Valley, Pa.

RAILROAD CONSTRUCTION and Maintenance Engineer, 20 years experience in track work, supervision of large forces of men, and construction equipment. PW-529. Engineering News-Record, 520 N. Michigan Ave., Chicago, Ill.

OPERATIONS MANAGER, thoroughly experienced all phases contracting desires permanent position in charge of estimating, purchasing, project management, etc. Excellent record and references. PW-530, Engineering News-Record, 330 W. 42nd St., New York, N. Y.

CIVIL ENGINEER, 38, Licensed, 19 years varied experience. Expert reinforced concrete designer, construction supervision, waterworks, public works, heavy foundations, sewers, rapid transit structures, sub-aqueous tunnels (compressed air) dwellings, garages, etc. Location immaterial. PW-539, Engineering News-Record, 330 W. 42nd St., New York, N. Y.

MECHANICAL-STRUCT. ENGINEER, 47, licensed, graduated, long experience in planning and supervising the erection of complete factories, and plant extensions, covering all power heating, electrical, water and sewage questions with first class references, seeks responsible position. PW-540, Engineering News-Record, 330 W. 42nd St., New York, N. Y.

STRUCTURAL STEEL and Reinforced Concrete Designer—Registered Engineer—New York City or Connecticut location preferred. Will take sub-contract. PW-541, Engineering News-Record, 330 W. 42nd St., New York, N. Y.

REGISTERED CIVIL ENGINEER available as Draftsman or Moneymaker in Earthmoving. PW-542, Engineering News-Record, 68 Post Street, San Francisco, Cal.

CHECKER AND DESIGNER with both field and office experience in designing and rebuilding machinery, plant and mill equipment, structural and general building work. Reply PW-543, Engineering News-Record, 330 W. 42nd St., New York, N. Y.

POSITIONS WANTED

CIVIL ENGINEER—graduate with 12 years of experience in highway and bridge construction as assistant resident engineer. 37 years old. Can furnish references. PW-544, Engineering News-Record, 68 Post Street, San Francisco, Cal.

DRAFTSMAN-ILLUSTRATOR and perfect letterer. Long experience general building construction, structural steel piping, reinforced concrete, etc. Available in N. Y. vicinity. PW-532, Engineering News-Record, 330 W. 42nd St., New York, N. Y.

CONSTRUCTION SUPERINTENDENT — Extensive experience supervising general building construction. Capable to handle any type operation. Offers services to contractor requiring well seasoned man. PW-526, Engineering News-Record, 330 W. 42nd St., New York, N. Y.

OPPORTUNITY OFFERED

SALES ENGINEER—experienced in layout and estimating of conveying equipment as used by contractors in handling of sand, gravel and other materials. Sales experienced desired. Barber-Greene Company, Aurora, Illinois.

PATENT ATTORNEY

PATENTS, TRADE-MARKS. Booklet, "General Information Concerning Inventions and Patents" and "Fee Schedule" sent without obligation. Established 1915. Lancaster, Allwine & Rommel, Suite 454, 815 15th St., N.W., Washington, D. C.

FOR SALE

TRANSIT AND LEVELS. New and used, sale, rent, repair, prompt service. O. Griner, 920 Oak St., Kansas City, Mo.

USED LIGHT BECKMANN transit with verticle circle, in fine condition. FS-545, Engineering News-Record, 330 W. 42nd St., New York, N. Y.

WANTED

2 COPIES in good condition Lavis Railway Estimates. F. Lavis, 30 Broad St., New York, N. Y

SALES ENGINEER

Permanent Position

Established firm of engineers and contractors, now engaged in building large defense plants, requires the services of an experienced sales and promotion engineer. Must be familiar with general construction and at least thirty-five years old; college graduate. Correspondence confidential.

SW-534, Engineering News-Record
330 West 42nd St., New York City

COMPLETE STONE CRUSHING or SAND and GRAVEL PROCESSING SERVICE

available on tonnage basis

We will install NEW, MODERN portable or semi-portable plant in any practical location. Capacities 100 to 150 Tons of stone per hour or 150 to 200 Tons of sand and gravel per hour.

ESTIMATES FURNISHED WITHOUT OBLIGATION

Address

Contractors Service Corp.

Box 579, Harrisburg, Pa.

TENTS

NEW and USED

Sizes from 20 x 20 to 80 x 200

Immediate Delivery

For CONCRETE CONSTRUCTION

TARPAULINS

BRAND NEW

18 ounces — Water Proofed

.05c Sq. Ft. up

BARNETT CANVAS GOODS CO.

132 Arch St., Phila., Pa.

Equipment Wanted and For Rent Advertising—page 114

TRACTORS—BULLDOZERS

RD-7 tractor, with bulldozer.
RD-6 Tractor-bulldozer.
International TD-40 tractor-bulldozer.
International T-18 Tractor-bulldozer.
D-4 **Caterpillar tractor-bulldozer.**
4—**Euclid Trac-Trucks** 9 yds., excellent.

LOCOMOTIVES & CARS

100 ton **Mikado steam loco.** stand. gauge.
2—**Whitcomb** stand. ga. 4½ tons, gas.
2—**Vulcan** 36″ gauge; 6 tons, gas.
8—3 yd. **V type** 36″ gauge cars.

BUCKETS AND STONE SKIPS

1—1½ yd. **Hayward** rehandling, clam.
1—¾ yd. **Haiss** rehandling clamshell.
20—**Steel Stone Skips,** 2 yds. capacity.
22 **Battleship** type, 2 to 3 yds.

PUMPCRETE MACHINES

1—**Rex** Model 190 with 800′ pipe.
1—**Rex** Model 180 with 1,000′ pipe.
1—**Rex** Model 160 with 500′ 6″ pipe.

CONCRETE PLANTS—MIXERS

1—**B. K.** Ready-Mix Concrete plant.
Butler 100 yd. 3 comp. weigh batcher.
Heltzel bin, 225 tons, 4 compts.
Ransome dual drum 27E paver.
2—**Koehring** 27E pavers.
2—**Koehring** 28S mixers, skids, gas.
Ransome 28S mixer, skids, electric drive.
27E **Smith** Tower Paver.
Koehring Model 50 Mud-Jack.
Jaeger 5 yd. Truck Mixer 1941.

SHOVELS & CRANES

1—**Marion** Model 362 Diesel shovels, 1½
2—**Lorain** 77 Diesel Shovel, 1½ yd.
Lima 101 1¼ yd. crane-shovel-dragline.
Lima 101 gas crane, with 100′ boom.
Northwest #6 crane, 60′ bm., fairleads.
P & H Tr. Cr., 3 axle, on pneumatics.
Northwest Model 105 gas shovel.
Browning loco. crane, 25 tons, steam.
Industrial loco. crane electric, 20 tons.
Bucy, Erie 41-B Steam Crane with 75′ leads, No. 9-B-2 Hammer, oil fired.
Marion Model 32, 1½ yd. steam shovel.
Bucyrus Erie Model 48 Diesel Shovel.
Buc. Erie Model 22B Crane, Shovel, Dragline, new June, 1940.
Buc. Erie 10B Shovel, Crane.
Lorain 60 Shovel.
Lorain 40 Shovel.
Buc. Erie 30 Air Shovel.
2—**Buc. Erie** 20B Air Tunnel Shovel.
Buc. Erie Electric Tunnel Shovel, 1 yd.

PUMPS

Allis Chalmers 10″ cent. electric.
8″ **Barnes** cent. gas, 35 HP drive.
8″ **Goulds** cent., gas, 35 HP drive.
8″ **Worthington** cent., elec. 40 HP.
8″ **Lawrence** cent., gas, 35 HP.
4″ **Barnes** Duplex Plunger, gas.
8″ **Goulds** Duplex plunger, gas.
4″ **LeBour** centrifugal, gas.
Westco 2 stage, elec. 110 gpm @ 100′.
4″ **Barnes** Duplex Pump, gas, port.

TRENCHERS

1—**Austin** Model 600 Trencher, 84″ x 28′.
1—**Parsons** Model 21 Trencher, 18″ x 7′.
1—**Parsons** Model 30 trencher, 19½x12′.
1—**Parsons** Model 40 trencher, 48″x14′.
2—**Cleveland** Baby Ditchers, Model 95.
Buckeye Model C-10-A-24″x14′.

HOISTS

9½ x 12 **Lambert** 3 drum steam hoist.
9x10 **Lidgerwood,** 3 dr. steam, skeleton.
4—7 x 10 D.D. steam, place for boiler.
9 x 10 **Lidgerwood,** 3 dr. steam, skeleton.
8¼ x 10 **Lambert** 2 dr. steam, skeleton
Sauerman 2 dr. 150 HP electric dragline.
American D.D. 60 HP gas.
Clyde D.D. 45 HP gas.
American D.D. 100 HP electric.

BOILERS

100 HP vertical, **International,** 125#. pressure, full code, new in 1940. Perfect.
400 HP **Scotch Marine Boiler.**
204 HP **Scotch Marine Boiler.**
150 HP **Erie Economic.**

PILE HAMMERS

1—#9-B-2 **McKiernan & Terry.**
1—#7 **McKiernan & Terry.**
2—#5 **McKiernan & Terry.**
3—#3 **McKiernan & Terry.**

ROAD ROLLERS

B.S. 10 ton 3 wheel, gas, scarifier.
Acme 10 ton, 3 wheel, gas, rebuilt.

ENGINES, GAS & DIESEL

125 HP **Continental** 6 cy. practically new.
Buda Diesel, Model D468.
Fairbanks-Morse 20 HP Diesel.
Buda 50 HP gas, type WTU.
GMC Diesel, stationary, 60 HP.
Atlas Imperial 75 HP Diesel.
Fairbanks-Morse 150 HP Semi-Diesel.

MISCELLANEOUS

C. H. & E. saw tables, electric driven.
I.R. air compressor, port., 310 cu.ft.
I.R. Type 315, two stage air comp. port.
Sullivan air compressor, 110 cu.ft., port.
Barber-Greene, #62 bucket loader.
I.R. Model 50, drill sharpener.
Generator Sets, electric and diesel drive.
3—**Tanks,** 20,000 gals. with steam coils.
Trailer Fruehauf 40 ton with tractor.
2—**I.R. Wagon Drills,** one Type D, one Type FM **Contractors** Shanty, 2 rooms, 10 x 35, skids.
3—**Cement Guns,** Model N-2.
15—**I.R.** Concrete Breakers C.C. 35 & C.C. 45.
25—**I.R.** X71 Rock Drills, C.P. 10, DCR 23.
250′ Concrete Trimie 10″, 12″ and 14″.

30 CHURCH STREET **RICHARD P. WALSH CO.** **NEW YORK, N. Y.**

BUY DEFENSE BONDS

LOOK OVER OUR

SPECIALS

BEFORE YOU BUY

Every item
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24"	5	⅛"	1/32"
24"	4	⅛"	1/32"
20"	5	⅛"	1/32"
20"	4	⅛"	1/32"
18"	4	⅛"	1/32"
16"	4	⅛"	1/32"
14"	4	1/16"	1/32"
12"	4	1/16"	1/32"

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HEAVY-DUTY
FRICTION SURFACE

Width	Ply	Width	Ply	Width	Ply
18	6	10"	6	6"	5
16"	6	10"	5	5"	5
14"	6	8"	6	4"	5
12"	6	8"	5	4"	4
12"	5	6"	6	3"	4

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